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HEALTH MANAGEMENT OF YOUNG SHEEP.

PASTURE RENOVATION AND LIMING AT MOTUIHI.

HEAVY losses of lambs and hoggets are suffered more or less every year in many parts of the Dominion, the principal trouble being stomach-worms causing parasitic gastritis. The past season witnessed an exceptionally heavy mortality in the flocks of various North Island districts, reports from certain North Auckland counties indicating in some cases losses of upwards of 50 per cent. of the young sheep. This serious check to the increase of the country's sheep-stock and deplorable loss of wealth cannot be viewed passively. It behoves every farmer concerned to be up and doing.

The trend of present-day veterinary science towards the extension of preventive measures and practice in relation to animal disease, as against treatment by drugs, fortunately is all on the line of better farming, and can thus be linked up to by the progressive farmer keen to apply improved methods of practical management. Experience has shown that young sheep, even in badly affected districts, may be kept practically free of parasitic gastritis, and successfully carried over the

critical period of their lives, by the provision of new pasture, and liming—simple operations which not only assist in saving valuable stock, but also mean solid additions to the improvements of the farm.

Nothing especially novel is claimed for the practice briefly recounted in these notes, but the heavy recurring losses show in themselves the need of presenting a practical object-lesson to many farmers. The demonstration concerns more particularly the average North Island farmer running sheep; in the arable districts of the South Island "speeding the plough" and pasture-renovation enter more into the normal rotational farming practice. As already indicated, the object-lesson is that of the striking effect of sweet, succulent new grass on the health and well-being generally of lambs and hoggets.

ONE OF THE NEW GRASS PADDOCKS AT MOTUIHI.

THE MOTUIHI EXPERIENCE.

In its capacity of a live-stock quarantine-station the Island of Motuihi (one of the archipelago in the Hauraki Gulf, off Auckland Harbour) has been controlled by the Department of Agriculture for a considerable number of years. Farming operations, chiefly of a pastoral character, with auxiliary cropping, have been carried out during this period. The use of the island as an internment camp since the commencement of the war has not interfered with the agricultural side of the place to any extent; in fact, the improvements carried out by the Live-stock Division have been mainly during the war period.

Motuihi is of a rolling conformation; its soil is loamy in character, and underlaid by clay, forming in some parts more or less of a hard-pan. The land was originally laid down in grass many years ago, but the finer grasses have run out on this pasture, giving place to coarse herbage, including a considerable proportion of ratstail. The island, which has a total area of between 300 and 400 acres, is kept well stocked, chiefly with Romney crossbred sheep.

Two or three years ago the Department commenced to renew the pastures and lime the land. The benefit of these operations in relation to the sheep-flock was soon demonstrated, although the area treated at first was too limited to completely meet the situation which arose. Great trouble was experienced in raising the main lot of 1916-season lambs. The lambs first went off in condition when put on the old pasture, although the latter just then looked fresh enough to the eye. In spite of having occasional changes on small areas of new grass and later on rape they continued to go back, the trouble being plainly parasitic gastritis. Owing, however, in no small degree to the great care of the overseer of the farm (Mr. A. W. Christie), the lambs were

SOME OF THE MOTUIHI 1917 LAMBS. PHOTOGRAPHED IN APRIL LAST.
Note contrast of old pasture on right of fence.

brought through with moderate loss only, the final turn for the better coming after they were placed on oat-stubble in January, 1917. With the exception of the best ewe hoggets reserved for breeding purposes, they have since all been disposed of fat.

This experience prompted the Department to push on actively with pasture-renovation and liming operations. In the autumn of 1917 an area of some 40 acres was laid down in new grass and limed. This paddock (subdivided as required) proved of extreme value in connection with last season's crop of lambs. It carried 350 ewes and lambs, on and off, for over three months—a fact which speaks well for the rapid establishment of the sward and the quality of the land, apart from the peculiar virtue of the young grass. The only check received by the lambs was during a short period when circumstances compelled their being placed on old pasture. A short spell on a paddock of young oats restored the situation, but the new grass proved the mainstay,

and despite a very unfavourable wet early season no further trouble was experienced with the lambs. During the summer good drafts of prime fats were taken off rape and young pasture. Only one lamb died of parasitic gastritis, this being in marked contrast to the disastrous percentage of loss experienced on a large neighbouring island, as also in mainland districts to the north of Auckland. The present acting-overseer (Mr. G. B. Melrose) confirms these good results as due in the main to the clean young grass and keeping the lambs and hoggets off the old pasture as much as possible. The sweetness and general palatability of the new grass is evidenced by the very close grazing given to it by the stock.

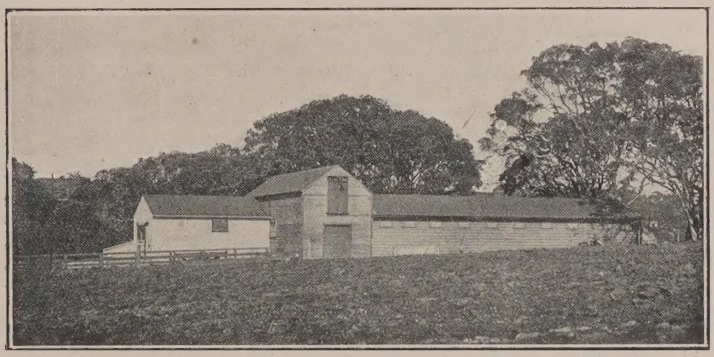
The Department is following up its pasture-renovation scheme. A further area of about 40 acres was laid down and limed during the

A PIECE OF THE OLD PASTURE AT MOTUIHI, ALSO SHOWING TILE DRAINS MARKED OUT.

past autumn, and before long the greater part of the island will have been dealt with. It may be mentioned that only a comparatively light dressing of ½ ton of burnt lime to the acre has been hitherto used; in future it is intended to increase the quantity. The dressing is given after harrowing the furrow and before sowing. The seeding used in the formation of the new pasture—about 45 lb. to the acre—is a cocksfoot-rye-dogstail mixture, with a rather large proportion of clover for the purpose of producing succulent autumn feed.

The retentive nature of the land on Motuihi calls for underdraining, while the conformation of the ground lends itself readily to this operation. A large amount of tile drainage has therefore been put down, and the work is being extended simultaneously with the re-grassing. The beneficial effects of the improved drainage are already very marked.

This simple and practical object-lesson from Motuihi Island is one that can be followed by practically every farmer having fairly arable land who is in difficulty with sheep trouble of the nature referred to. He may rest assured that the outlay will be recouped with handsome profit to himself, while also reacting on the prosperity of the country generally.



THE STEADING AT MOTUIHI. THE TREES ARE POHUTUKAWAS.

DESTROYING CALIFORNIAN THISTLE BY CULTIVATION.

ONE of the best methods of getting rid of Californian thistle on arable land is to plough the affected ground in winter to a depth of 9 in. or 10 in., which cuts the tap-root. Then during spring work the cultivator through the patches once a week and in summer every ten days, never allowing any shoots to grow. Early in February sow the ground with Algerian oats, which should be ready for feeding off in May. If desired, the crop may then be left to ripen, and in a favourable season can be harvested before the thistles (if any are left) come to the flowering stage. This applies only to Algerian or Ruakura oats, which mature early, other varieties being too late in ripening. Mr. Williams, of Maronan, was the first to draw my attention to this method. He claims that by its means it is easier to kill the thistle than twitch, and numerous other farmers I have spoken to have been equally successful. These remarks deal specially with the Ashburton district, but doubtless will apply to many other parts of the Dominion.—*C. Branigan, Fields Inspector, Ashburton.*

A Raglan correspondent states that he is troubled with wekas, and wishes to know the best way to get rid of them. Wekas are absolutely protected in all parts of the Dominion.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.*

(Continued.)

By B. C. ASTON, F.I.C., Chemist to the Department.

ANACARDIACEAE.

THIS is a family which contains *Corynocarpus laevigata* Forst., the well-known karaka of the Maori, one of the most remarkable and abundant of the North Island coastal trees. The karaka was beloved of the Maoris, for it furnished one of their farinaceous foods, and was planted by them round their villages. Tradition has it that the karaka was brought by the Maoris to New Zealand from Hawai-iki, their ancestral home, and the discovery of two other species of *Corynocarpus* in Polynesia lends colour to the story. What interests a chemist is the fact that the Maoris had a knowledge of how to destroy the intensely poisonous character of the large kernel of the fruit in order to convert it into a nutritious carbohydrate foodstuff, a class of food of which they had a somewhat restricted choice. The chemistry of the fruit has been investigated by Skey, 1871 (Trans. N.Z. Inst., vol. 4, p. 316), and by Easterfield and Aston, 1901 (Trans. N.Z. Inst., vol. 34, p. 495, and Proc. Chem. Soc. 34, p. 495). Skey isolated a crystalline bitter principle which he named "karakine," but did not prepare sufficient to analyse or test its physiological action. He stated that it did not contain nitrogen. The later investigators isolated, by a method differing from Skey's, and analysed Skey's compound, which melted at 122° C., and had the formula $C_{15}H_{24}O_{15}N$. They determined that the compound is a nitrogenous glucoside, and therefore must be called "karakin," and it is only slightly toxic when removed from the enzymes with which it is associated in nature. It is probably a cyanogenetic glucoside. When the "nut" is distilled with water the distillate gives the reaction for hydrocyanic acid (prussic acid). A second glucoside, "corynocarpin," melting-point 140° C., crystallizing in fine needles, but less soluble in alcohol than karakin, was also isolated.

Baber, 1886 (Trans. N.Z. Inst., vol. 19, p. 320), states that the leaves and twigs are valuable forage for cattle, and that the yellow fleshy pericarp is nutritious. Children are certainly fond of it. As the fruit falls from the tree it is greedily eaten by cattle, which, according to one settler at Awhitu, Auckland, become much excited and lose all power of control over their hind legs, milking-cows being more affected than dry cattle, and the former will rapidly dry up. Other settlers, however, informed Baber that their cattle eat karaka fruit with impunity. He explains this difference by assuming a greater

* By request the title of this series of articles has been enlarged to include those medicinal plants which could not be termed poisonous or suspected poisonous.

consumption of the fruit in some cases than in others, Awhitu having always been celebrated for it karaka groves. Pigs which feed on karaka fruit are said to exhibit a partial paralysis of the hind limbs.* The writer found that by baking the fruit in the oven like chestnuts all bitter taste was destroyed and the kernels became palatable and innocuous.

CORIARIAE.

This family contains the most important New Zealand poisonous plant, the tutu, quaintly and erroneously spelt "toot" by some investigators. The tutu will always possess a great interest for New Zealand farmers so long as there are plants on his waste lands and river-banks, for there will always be cases of poisoning of stock, and even occasionally, it is to be feared, of children also.

The genus *Coriaria* is very widely distributed and the species are closely allied. In southern Europe and northern Africa occurs *C. myrtifolia,* in the Himalayas and China *C. naepalensis,* in Japan *C. japonica,* and in Central and South America *C. thymifolia.* A full account of the poisonous principles of the three New Zealand species of *Coriaria*—namely, *C. ruscifolia, C. thymifolia,* and *C. angustissima*—was published by the Department in "Tutu," Part 1, 1900, and Part 2, 1901, which is still available for free distribution. (See also annual reports for those years.) It is therefore only necessary to detail information which has become available since the date of that publication.

The successful chemical research of tutu is an example of how progress in one branch of science helps workers in other different branches. The isolation of the active principle of the tutu by chemists has stimulated the physiologists, who are always more willing to experiment with pure principles than with mixtures of unknown composition in investigating the action of poisonous plants. Professor C. R. Marshall (1906), of St. Andrew's and Dundee University, who had been working with tutin since 1901, published a preliminary report on the physiological action of tutin in the *Journal of Physiology,* vol. 34 (see p. 223 of 1908 Annual Report of N.Z. Department of Agriculture). He followed this up with an important paper in 1909, in the Transactions of the Royal Society of Edinburgh (vol. 47, pp. 287–316; see also report, British Association, 1912, pp. 643–44). The previous year Dr. Frank Fitchett had published as his "highly commended" M.D. thesis, "A Contribution to our Knowledge of the Physiological Action of Tutin" (Trans. N.Z. Inst., vol. 41, pp. 286–366), and in 1909, with Professor J. Malcolm (Otago University), he published in the *Quarterly Journal of Experimental Physiology,* vol. 2, No. 4, pp. 335–62, a further paper summarizing their exhaustive work. Professor Malcolm has since (1913) published "Some Experiments on Tutin and Tutu Poisoning" (Trans. N.Z. Inst., vol. 46, pp. 248–54). An American worker, Dr. W. W. Ford, of the Baltimore Medical School, has also published some physiological experiments in the *Journal of Pharmacology and Therapeutics* (vol. 2, 1910).

These four workers were supplied by the writer with the pure tutin necessary for their work, prepared by him from New Zealand species of

* The raw fruit is very poisonous to dogs. One "nut" given to a large dog caused severe convulsions.

Coriaria, and the result is that our knowledge of the physiological action of tutin is now considerably advanced.

The results of the physiological researches are necessarily extremely technical. Professor Marshall's main conclusions were reprinted in the Proceedings of the New Zealand Institute, 1910, Part 1, p. 27, vol. 43, and may be consulted in any reference library. It is satisfactory to learn that this authority had the advantage of studying the New Zealand physiologist's results before publishing his paper, and considered that, so far as their experiments were common to his, both results were in general agreement. Dr. Fitchett and Professor Malcolm's work is also available in the Transactions of the same Institute, while a long abstract of their work, together with suggestions for treatment of human patients suffering from tutu poisoning on the basis suggested by Professor Marshall, is given in the Annual Report of this Department for 1908, p. 221. A note by Professor Marshall on remedial treatment was published in the report of the Department for 1905, p. 79.

Recent advice from the veterinary side as to the treatment of "tuted" animals has been given by Mr. A. R. Young (1917), "Tutu Poisoning in Cattle," in this *Journal*, vol. 15, p. 307.

The foregoing references are given for the guidance of those who have to deal with cases of poisoning from this dangerous plant, which occurs generally in the spring, now almost upon us.

Passing in review the extent of our knowledge regarding the genus *Coriaria*, it must be admitted that it is singularly limited. The European plant is to some extent a commercial plant, furnishing a dye and tannin as well as a drug—the crystalline active principle coriamyrtin which has been used in medicine. It is very similar in physiological action to tutin, but more toxic, and is probably closely allied to that crystalline principle which each of the three New Zealand species of *Coriaria* contains. For a full discussion of the points of difference, Easterfield and Aston's papers, 1900, should be consulted (Trans. N.Z. Inst., vol. 33, p. 345, and Trans. Chemical Society of London,* vol. 79, p. 120). The European and New Zealand plants have been fairly well examined, but little is known concerning the Himalayan or Chinese *C. naepalensis*. When working on tutu in 1909 the last-named investigators obtained spirit and dry specimens of the latter species through the courtesy of Mr. A. C. Hartless, Superintendent of the Saharanpur Botanical Gardens. Although two large drums of the young shoots in alcohol were worked with, no trace of an active principle could be isolated in the methods used to obtain tutin. Extracts were further submitted to Mr. H. A. Reid, F.R.C.V.S., of this Department, who failed to obtain any physiological response from mouse, rabbit, or guinea-pig when dosed with the extracts. Judging from the reports of his Indian correspondents the present writer is of opinion that the species is slightly toxic. Near Mussoorie, U.P., above 4,000 ft., the plant is extremely common, although on one range it is not so common, owing, it is said, to the "masuri" or the "masura," as it is called, having been cut for cattle-fodder. The leaves and the young shoots are greedily eaten by

*A curious mistake has crept into literature owing to the dropping of a line in this paper in the *Journal of the Chemical Society*. The correct reading being a dose of 0·129 gram *killed a pig weighing 17 kilos in five hours, and 0·01 gram* killed a kitten weighing a kilogram in forty minutes. The words italicized were omitted in the paper, from which it appeared that it took a very large dose to kill a kitten.

goats, sheep, and cows, while the fruit is the principal diet of the grass-cutters, who are out all day in the summer. If too much of the fruit be eaten—say, 4 lb. or more—it is supposed to cause giddiness in the coolies. The "Cyclopedia of India" (Quaritch), 1885, confirms the statement that the fruit of *C. naepalensis* is eaten.

Endeavour was made some years ago to obtain a supply of the American *Coriaria*, but without success. Pammel states that the Peruvian plant is *C. sarmentosa* Forst., a synonym of the New Zealand *C. ruscifolia*. Colenso, 1868 (Essay, Trans. N.Z. Inst., vol. 1, p. 23), states that two at least of the New Zealand species are common in south Chile. The writer can find no record of the American or Asian plants having been investigated, although the *United States Dispensatory* (19th edition) states, without reference, that a Mexican drug, tlolocopetl, is obtained from a poisonous *Coriaria*.

(To be continued.)

RECLAMATION OF PEAT BOGS BY GRAVELLING.

HYDRO-ELECTRIC POWER AND THE WAIKATO SWAMPS.

By J. ORCHISTON, M.I.E.E., Wellington.

IT may not be generally known that if peat bogs are covered with a few inches of gravel or gravelly matter they can be made to produce first-class crops of grass, and that the results are sure and lasting. The bog need only be drained to a depth of 3 ft. to 4 ft.

Some thirty years ago I observed a very good crop of vegetables grown by one of the railway surfacemen at Eureka Siding on the Piako Swamp as the result of a top-dressing of some 6 in. of pumice ballast. I then made calculations as to the cost of top-dressing the whole of the peat bog by means of rail haulage, but found that the cost would be several times the prospective value of the land when reclaimed.

Professor F. H. Storer, of Harvard University, in his work, "Agriculture in some of its Relations with Chemistry," gives some valuable information on the subject. The following extracts from vol. 2, pages 203 to 210 (7th edition, London, 1897), are well worthy of reproduction. He states,—

> In recent years the process of covering moorland with gravel has been systematized in north Germany, and no little attention has been given to the scientific study of it. In cases where the layer of peat or moor-earth is from 1½ ft. to 3 ft. or more thick, in view of the fact that the country is absolutely flat, without any hills or knolls from which gravel might be transported to the moorland on sleds or railway, the operations consist in digging deep, wide ditches at stated intervals, and spreading upon the surface of the moor the sand or gravel which is taken from the bottom of the ditches. This layer of gravel is made 4 in. thick, and upon it the crops are grown. . . . A gravelly sand is said to be best; and, in general, the more gravelly the subsoil the better, provided it contains some clay. In Ireland particularly good results have been obtained by using limestone gravel.

Oats may be sown at once upon the layer of gravel, and afterwards potatoes, roots, grain, and all kinds of forage plants. The main point is that the layer of gravel is left permanently upon the surface of the land. It is never ploughed under, nor mixed with the moor-earth. Ordinarily the gravel layer is ploughed no deeper than 4 in.; but from time to time, at rare intervals, when the surface land seems somewhat hard or encrusted, a subsoil-plough is run through the beds, so as to loosen the soil without mixing one layer with another.

The layer of gravel is useful in several ways: it compresses the moor-earth and prevents it from passing into the light, incoherent, non-capillary, infertile condition which it would be apt to assume if it were to be cultivated directly in the ordinary way, immediately after draining, and if it were left exposed freely to the action of the sun and wind. One highly advantageous result is that the gravel tends to shield young crops from night frosts in the spring. It lessens the evaporation of water from the soil, and cools off so slowly that the land is kept comparatively warm, while later in the season it ensures the coming-up of a constant supply of capillary moisture, even when the weather is so dry that drained moor-earth by itself might dry out. Hence a gravelled moor can safely be drained to greater depths than an ordinary moor.

It is noticed that when the gravel or sand has become dry at the surface this dry layer acts as a mulch to hinder the evaporation of water from the soil beneath. Thus the soil is kept moist and, so to say, mellow continually, and in such condition that the roots of crops find proper support, and that the humus undergoes changes which fit it to serve as plant-food. Land thus covered with gravel admits of being tilled in the spring earlier than the adjacent uncovered land, and crops grown upon it are less liable to be thrown out by the frosts of winter. It is counted as an advantage that in preparing the gravelled moors for crops they need not be ploughed deeply. As was just now said, a furrow of 4 in. is deep enough. Such land is no longer in any danger of being destroyed by fire.

It is to be understood, of course, that the moor must be well drained before this method of cultivation, or any other, can be adopted. It is said that, as a general rule, the water-table should be kept some $3\frac{1}{2}$ ft. or 4 ft. from the surface of the soil, though for grass-fields it need not be so low as this. . . .

Carsten, in Holland, tried the experiment of growing oats on contiguous plots of moorland, each $\frac{1}{5}$ acre in area, some of which had been reclaimed by covering the land with gravel, while others had been reclaimed by mixing the gravel and moor-earth. In every instance where the gravel and moor-earth were mixed the crops obtained were inferior to those from the gravel-covered land. . . .

It has been found in practice that this method of reclaiming low-lying moorland (by gravelling) yields better crops than can be got from the moors by any other known process, and that the effects of the reclamation are sure and lasting. Whether or not it is the most economical of known methods is, of course, a totally different question. . . . The great cost of covering a bog with gravel in this way limits the applicability of the process to countries where labour is abundant.

Since the publication of Professor Storer's work the development in the transmission of hydro-electric power has wholly changed the conditions. Comparing hydro-electric power at £5 per h.p.-year with manual labour at as low as, say, 2s. 6d. per diem, the following conditions apply: An electric horse-power is assessed as being equal to eight men working continuously without cessation, but as men do not even work eight hours without some short spells the equivalent of two extra men should be allowed for in making a fair comparison. Therefore thirty men would be required to complete the day of twenty-four hours. Thirty men at 2s. 6d. per diem for 365 days would cost £1,368 15s., or 273 times the cost of the equivalent in hydro-electric power. It is therefore evident that if the hydro-electric power can be efficiently harnessed to do the work there can be no comparison between the two methods from a cost point of view.

There are many thousands of acres of peat bogs in the Waikato district largely of considerable depth. As there is ample fall, these bogs can be readily drained to a depth of 4 ft. (all that is required for

a system of top-dressing, but of no value in itself without the top covering). Where the railway passes over these bogs the surface has been on fire practically every summer for the last thirty-five years, lowering the level adjacent to the line by several feet in most parts. In spite of this continuous burning the resultant ash is not sufficient to support plant-life other than that of moss or similar unproductive growth. It is only where the depth of the peat has not been great, mostly near the margin of the swamps and where it could be drained to the bottom with a considerable burning-off of the surface, that any practical results have been obtained, and, as Professor Storer aptly describes, where drained and without top-dressing it passes into a light, incoherent, non-capillary, infertile condition.

Surrounding the Waikato swamps there is plenty of high country from which spoil could be readily conveyed and distributed by means of iron pipes. To give a practical illustration: If electric force-pumps, supplied with power from the Horahora hydro-electric generating-station, at £5 per h.p.-year, were utilized to elevate water to a height of, say, 200 ft. up the side of any of the surrounding hills, and there forced against the surface under a pressure of, say, 200 lb. to the square inch, vast quantities of spoil would be displaced which could be led into delivery-pipes by means of chutes. A head of 200 ft. would give ample pressure to convey 5 per cent. of spoil in suspension and deliver it through ten miles of piping if need be. Of course, for shorter distances less height would be required, and consequently less power would be expended for a given quantity conveyed. If found more advantageous, pumice gravel could be similarly pumped on to the bogs from the banks of the Waikato River, or wherever conveniently obtainable.

I may here add that electrically driven force-pumps are now raising water in one lift to a height of 2,500 ft. for the town supply of Simla, in India. The power is obtained from a hydro-electric station many miles distant. I mention this to indicate that there is nothing visionary in the proposal to use electric force-pumps in the manner suggested.

To deposit, say, 6 in. of spoil over the surface in close contiguity to the force-pumps would cost approximately £1 10s. per acre for the electric power alone, at £5 per h.p.-year. As the distance of the delivery is increased the power expended would be correspondingly greater. In addition to the cost of power there would be a certain amount of labour required for placing the pipes in position, moving, coupling, and uncoupling them as required. The cost of pipes and machinery would also be a charge against the scheme. Nevertheless, the whole cost of the reclamation would be far below that in northern Europe with labour at 2s. 6d. a day.

There are at least 50,000 acres in the Waikato practically producing nothing at present, which, it may be confidently claimed, could be converted into some of the richest land in the country by the means indicated.

There should be no fixed ration for a flock of laying-hens; they must be fed according to their appetite and at regular times. It is useless looking for a high yield of eggs if the birds are only given sufficient food for their bodily upkeep.

LIMITATION OF INJURIOUS INSECTS BY BENEFICIAL SPECIES.

By DAVID MILLER, Entomologist.

It is noteworthy that if, when a new territory is opened up for agricultural purposes, new conditions are established favourable to the indigenous insects the ravages of such species as are likely to develop injurious habits at once become apparent as an economic problem. Under such conditions injurious insects are more extensive in their depredations than in countries where agriculture has been well established for considerable periods. The reason for this lies in the fact that in older countries a universal and regular system of cultivation has been adopted and carried out over such a long period that the environment has become normal, and an equilibrium established between the injurious insects on the one hand and their natural enemies and other controlling factors on the other. Conversely, in a new country, such as New Zealand, on the advent of cultivation the natural equilibrium is upset, and new conditions suddenly established which may be favourable to the abnormal increase of many of the indigenous insects, particularly the phytophagous (plant-feeding) forms, which, on account of the ever-increasing areas of cultivated vegetation, readily turn their attention to this new, easily obtained, and palatable diet in preference to their own limited natural food-supply, with disastrous results to the crops and an abnormal increase of the destructive species, which consequently go to swell the ranks of the already too numerous injurious insects. It is frequently to be noted, however, that such indigenous species as develop injurious habits, although periodically increasing with marvellous rapidity and at these times causing extensive damage, will suddenly become normal and remain so until opportunity offers for a further outbreak. Such sudden outbreaks of insects are better understood when we remember that the number of eggs produced by a single female is greatly in excess of those that normally reach maturity. Thus, if favourable conditions occur, such as a sudden abundance of a suitable food-supply or a more or less temporary cessation of the attacks of entomophagous (predaceous and parasitic) insects, a much greater percentage of the injurious offspring in question have an abnormal chance of survival, and this is immediately taken advantage of until reduced to normal by the re-establishment of the controlling influences.

Illustrating this phenomenon is the New-Zealand-flax moth (*Xanthorhoe praefectata*), which has caused considerable loss to the flax-milling industry.* This is an unique example, since both the food-plant—New Zealand flax (*Phormium tenax*)—and the moth are

* See the writer's articles in the *Journal* for June, July, and December, 1917.

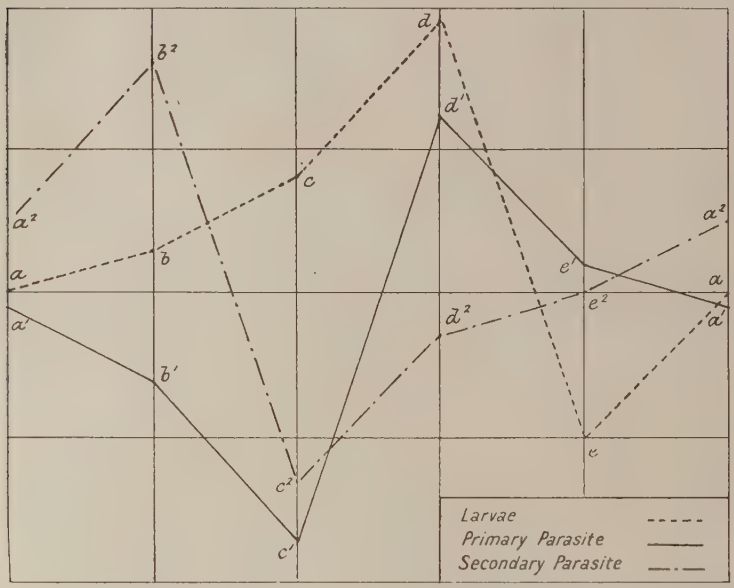
indigenous. Under normal conditions the *Xanthorhoe* larvæ confine their attention to flax growing in comparatively dry conditions; but as the flax industry extended swamp areas heretofore saturated in water were drained and rendered more or less dry, a luxuriant growth of flax appearing simultaneously, with the result that the larvæ, having at their disposal an extreme abundance of their natural food and suitable soil and shelter conditions, increased with alarming rapidity.

The history of this insect shows that the attacks are more severe at some periods than at others, and periodically almost disappear from hitherto badly infested areas. The fluctuations of these larvæ are mainly controlled by one or other of the two following factors, or a combination of both. If, where the areas are subject to inundation, a flood or a series of floods occur, either when a brood of larvæ has just emerged from the eggs or when a brood is pupating in the soil, most of the individuals, particularly in the latter case, will be destroyed and few will reach maturity. Conversely, a period free from floods, even though comparatively brief, will encourage the abnormal development of the species.

On the other hand, several entomophagous insects bear upon this problem. The most important of these is a small ichneumon-wasp which heavily parasitizes the *Xanthorhoe* larvæ. In one area in particular it was found that the larvæ were more or less normal; the next brood was on the increase and a few were found parasitized; the following brood of moths was extremely large, with the result that the young larvæ arising therefrom swarmed over the flax-leaves. These last larvæ were heavily parasitized and, as was expected, very few moths emerged; the larvæ of these latter were still more heavily parasitized and did but little damage. This ichneumon-wasp parasite attacks the larvæ on their emergence from the egg and finally destroys them before they are half-grown, so that under such conditions attacks upon the flax-leaf are comparatively slight. This parasite, however, is in turn attacked by a secondary or hyperparasite*, upon which turns the key to the problem of control by the ichneumon-wasp. It is probably due to the factors controlling the hyperparasite whether the *Xanthorhoe* larvæ are checked by the primary parasite or allowed to abnormally increase. From what is now known it is probable that in the first instance mentioned above, when the larvæ were more or less normal, the hyperparasite was not present in sufficient numbers—at least before this brood of larvæ had been attacked by the ichneumon-wasp—to affect to a great extent the primary parasite of the flax-larvæ, which in consequence were held in check. On the flax-larvæ becoming abundant the hyperparasite was also on the increase, and, conversely, when less abundant was on the decrease. So that we may conclude that the superiority or inferiority of the hyperparasite and the damage caused by *Xanthorhoe* larvæ are inversive to the superiority or inferiority of the primary parasite. Consequently the damage caused by *Xanthorhoe* larvæ is fundamentally dependent upon the activity of the hyperparasite, the factors controlling which are not yet known.

* Hyperparasites may be secondary, tertiary, or quaternary.

The foregoing observations may be shown theoretically by the following graph:—



GRAPH ILLUSTRATING THE RELATION OF XANTHORHOE PRAEFECTATA TO PRIMARY AND SECONDARY PARASITES.

In the above figure the *Xanthorhoe* larvæ are represented as normal at *a*, the primary parasite at e^1, and the secondary parasite at d^2. Owing to a limitation of the controlling influences the secondary parasite increases at e^2, influencing the primary parasite at e^1, which is reduced in the following generation (a^1), with the result that the *Xanthorhoe* larvæ, though normal at *a*, are less under the control of the primary parasite and increase at *b*. The secondary parasite goes on increasing through a^2, until a maximum is reached at b^2, when the controlling influences are again established and this parasite is reduced to a minimum at c^2. The secondary parasite being at its maximum at b^2, the b^1 generation of the primary parasite is so much affected that it also falls to a minimum at c^1, the *Xanthorhoe* larvæ in the meantime increasing to a maximum at *d*; but the practically uncontrolled primary parasite at c^1 has a free hand with the maximum *Xanthorhoe* larvæ (*d*) at d^1 before much damage is caused by these larvæ, although a certain percentage of the primary parasite at this stage is affected by the d^2 generation of the secondary parasite. The latter, again returning to normal, and attacking, as it does, the primary parasite after the *Xanthorhoe* larvæ have been destroyed, cause these larvæ to be suddenly reduced to *e* in the next generation, while the primary parasite returns to normal at e^1.

Other instances of indigenous phytophagous insects developing injurious tastes are those of the New Zealand army-worm (*Melanchra composita*) and the New Zealand grass-grub beetles (*Odontria* spp.). Insufficient information is available concerning the *Odontria* species, but their life-histories are being worked out. The larvæ of *M. composita* at times occur in serious outbreaks, moving through crops of oats, and

frequently leaving very little standing in their wake. The natural food of this species is native grasses, which, as opportunity offers, they will discard for the more succulent and abundant food-supply to be found in the farmers' crops.

As seen from the foregoing, a certain amount of damage is caused to cultivated areas through the depredation of native insects, but by far the greatest loss is incurred by injurious forms accidently carried with imported products from other countries. These insects rapidly increase under the new conditions, a principal feature of which is the absence of their natural enemies (controlling them in their original home), which if introduced and established would be an invaluable factor in the control of the injurious species, perhaps more so than in their native country, where they themselves are subject to controlling influences.

An outstanding local exemplification is the gum-tree scale (*Eriococcus coriaceous*),* a native of Australia, where it does but little damage on account of the controlling entomophagous insects. The first noticeable outbreak of this scale occurred in gum-tree plantations—chiefly blue-gums (*Eucalyptus globulus*) and *E. Stuartiana*—in the vicinity of Timaru, about the year 1900, when it was reported that widespread destruction was being caused. Parts of these plantations had been planted by the early settlers more than forty years previously. Since *Eriococcus* was observed upon the bark of imported Australian hardwood timber at Timaru, and since the scale became apparent simultaneously with the arrival of such timber, the assumption that hardwood was the primary means of infestation is probably correct. Before 1905 the scale had spread north and south, covering a distance of over 180 miles from the original centre of the establishment—that is, northward to within twelve miles of Christchurch and southward to Palmerston South. The damage was so extensive that trees of a number of species were being killed outright. At this time control measures were undertaken, and consignments of several species of ladybirds controlling this scale in other territories were introduced from North Auckland—where they had been previously liberated by the Department to control the Norfolk-Island-pine scale (*Eriococcus araucariae*) and from Australia. Of these beetles, *Rhizobius ventralis* was found to be most suitable to the climatic conditions of Canterbury, where it became so well established that within three years the gum-tree scale had been reduced to a negligible quantity. If the ravages of this scale had been left unchecked the loss to the Dominion would have been very serious, since (according to the bulletin referred to) there were at the time when the scale was at its height over 10,000 acres of gum plantations in Canterbury and Otago, the value of which then exceeded a million sterling.

This elimination of an injurious insect through the agency of a natural insect foe is a phenomenon continually met with. The gum-tree scale and the New-Zealand-flax moth show the effect of a predaceous and parasitic enemy respectively. In the case of the scale the attack

* A full account of the occurrence of this insect in New Zealand was given in the Department's bulletin, "The Gum-tree Scale," by T. W. Kirk and A. H. Cockayne, issued 1909.

of the controlling influence was due to both the larvæ and the adults of the ladybird beetle. The predaceous species has an advantage over the parasite, such as that attacking *X. praefectata*, since a single individual of the former will destroy a number of the pest during its life, while an individual larva of the latter is capable of accounting for only one individual of *X. praefectata*.

Strange as it may seem at first sight, when the entomophagous insect commences to reduce an outbreak of its host, although the latter is superior both in numbers and in fertility, it will be in a few generations in excess of its host. For example, in one locality, when the parasite attacking *X. praefectata* was first in evidence, about 30 per cent. of the larvæ of the latter were parasitized. Theoretically and apart from other influences, let it be assumed that the parasite and the moth each produce a hundred eggs, and that of these half are males and half females (although in reality the males of the latter insect are more numerous than the females, which, however, is more or less balanced by the fact that this moth produces considerably more than the number of eggs assumed). If this be worked out it will be found that in the fourth generation the parasite will have greatly exceeded its host. At this stage, in the case of a parasite confined to one host, and owing to the consequent lack of a sufficient supply of the latter for the well-being of the abnormal numbers of the parasite, the excess of the latter will of necessity perish, until only sufficient remain to retain the normal equilibrium. By working out several examples on such theoretical lines, commencing even with the minimum of parasites, it will be found that the parasite will gradually exceed its host, although the greater number of generations taken to overcome the injurious species the longer will be the period of devastation.

Another problem which is occupying considerable attention at present concerns the depredations of the meadow-foxtail midge larvæ (*Oligotropus alopecuri*) upon the developing seed of meadow-foxtail grass.* Before this midge was considered to be serious there was every likelihood that sufficient quantities of meadow-foxtail seed would be produced in New Zealand for local and export purposes. The only areas of production are in the Manawatu and Tauranga districts, but owing to the midge there is now no seed grown in the former district, where the annual output was formerly 18 tons. In the Tauranga district there is apparently some factor controlling the midge, since but little damage is caused as compared with the Manawatu. Such was the state of affairs at the close of 1916. Amongst the foxtail-seed imported from Europe is a certain quantity infested by the midge, which is doubtless the means by which the pest was introduced. It was not until about 1910 that seed grown in New Zealand was first observed to be infested, but four years later, in 1914, the midge became a serious problem in the Manawatu, while in 1915 fully 70 per cent. of the seed was rendered useless, and in the following year this percentage was even higher. This will show to what extent an exotic insect will develop, and what damage can be done when established under a new and favourable environment removed from the normal controlling factors.

* See article, "The Meadow-foxtail Midge," by A. H. Cockayne, in the *Journal* for December, 1916.

In Europe, though this midge is present, only about 8 per cent. of the foxtail-seed is attacked, a fact due to the presence of the natural influences which preserve an equilibrium.

It is quite well known that the early settlers of this Dominion were able to grow various exotic fruits without fear of loss from exotic insects, but these became so well established in later years that fruit-growing threatened to come to a standstill. Owing, however, to organization and the application of effective mechanical means of control the orchard pests are now fairly well in hand, as evidenced in recent years by the rapid development of the fruit industry.

It is noteworthy in connection with live-stock that amongst the indigenous insects of New Zealand there are none which have developed injurious habits to a noticeable extent. This is probably due to the fact that before the advent of man in the country there were no mammals allied to those comprising our live-stock which would serve as hosts for such indigenous insects as would likely attack such animals. This was a state of affairs contrary to the indigenous conditions upon which depended the native phytophagous insects, some of which, as has been pointed out, are now injurious species. However, for example, although the larvæ of our blow-flies (*Calliphora* spp.) are normally carrion-feeders, there is a possibility of their becoming injurious, as has been the case with allied species in other countries. Again, on the whole, comparatively little loss is incurred even by such introduced species as are known to be troublesome to live-stock in their native territories. Moreover, owing to the rigorous inspection of imported products the chance of any further pests being introduced is at a minimum. The value of such procedure is well illustrated at the present time by the extending trade which is being opened up with Japan, and the consequent danger of a new phase of insect-life being introduced from that direction.

SUMMARY.

From what has already been said it will be seen that upon opening up a new country two phases of insect-life present themselves — on the one hand, the rapid development of exotic injurious insects when established under an environment free from their natural controlling influences, and, on the other, the possible assumption of injurious habits by indigenous species, owing to the upsetting influence of cultivation upon the natural harmony of the country.

Under the normal equilibrium the phytophagous insects (apart from the attacks of insectivorous birds, &c.) are dependent for their well-being, on the one hand, upon the amount of available food, and, on the other, upon the numerical superiority or inferiority of the controlling native entomophagous insects; and the prolificness of the latter, in turn, is correlative not only to the abundance or rarity of their hosts —the phytophagous forms—but also to the presence or absence of their own insect enemies—hyperparasites. Therefore the presence of a sufficient and suitable vegetable food-supply is fundamentally essential not only for the existence of phytophagous insects, but also for the entomophagous forms, since the former are dependent upon the available vegetation and the latter insects upon the former.

When an outbreak of some phytophagous insect occurs, owing to the establishment of favourable conditions, there are many features to

be considered apart from mechanical means of control—for example, the effect of entomophagous insects, and the duration of the injurious insect's life-history, combined with its relation to various food plants. It has been found when dealing with a native injurious species that the effect of its natural insect enemies is not permanent, since the latter are under the subjection of their own controlling influences, as is shown by the history of the New-Zealand-flax moth. In such a case, if permanent results were to be obtained by means of parasites, the introduction of some exotic foe having for its natural host a species allied to the indigenous injurious one would probably be successful provided it became established. On the other hand, as illustrated by the history of the gum-tree scale in New Zealand, in dealing with exotic injurious species the establishment of their own natural enemies would be of permanent value.

When a phytophagous insect attacks one species of plant more than another efficient results may be obtained by a thorough system of crop-rotation, at the same time paying particular attention to such places as are likely to afford suitable conditions for the insect's hibernation—for example, rank growths of grass usually to be found fringing the fields under cultivation. In this way, by breaking the continuity of the food-supply, the life-cycle of the insect is interrupted owing to the lack of sufficient sustenance to enable its abnormal development, and by removing the winter quarters a considerable proportion of the over-wintering stages will be destroyed, with a consequent reduction of the spring brood.

Of the two classes of dips on the market—poisonous and non-poisonous—usually the former is a powder dip and the latter liquid. When the poisonous dips are mixed strictly in accordance with the manufacturer's directions they are, as a rule, effective for a fairly lengthy period. The non-poisonous dip is generally used as a temporary dip for lambs and to keep the sheep clear of ticks, &c., until the recognized dipping season with poisonous dip.

LIVE-STOCK INSTRUCTION TO SCHOOL-CAMP CLASS AT MOUMAHAKI.

GRIMM LUCERNE.

INTRODUCTION IN NEW ZEALAND.

By A. MACPHERSON, Fields Supervisor, Christchurch.

THE Grimm variety of lucerne is a specially selected strain which originated in Minnesota, United States of America, and is noted for hardiness and productiveness. It took its name from the farmer said to have been one of the most prominent in calling attention to the variety and promoting its dissemination. The potential value of this lucerne in many parts of the United States and Canada is so great that no efforts are being spared in those countries to bring about its general use in areas where experiments have indicated its special worth compared with other varieties.

The great hardiness of Grimm lucerne has been amply substantiated by the investigations of the United States Bureau of Plant Industry, and by independent experiments conducted at many of the State experiment stations and in Canada. There is strong reason to believe that it is the hardiest known form of the cultivated plant. It not only endures extremely low temperatures, with or without snow, and other untoward conditions, but it can be cut with safety later in the autumn, and will bear more abuse in the way of pasturage than any other kind thus far grown in comparison with it. There are cases on record in which Grimm lucerne has borne, without serious loss of stand, temperatures as low as 38 degrees Fahrenheit below zero, with practically no snow covering. It has been grown successfully in climates where the mean duration of the frost period is almost 140 days.

To the casual observer Grimm lucerne looks very much like all other lucernes, but on closer examination it is found to be considerably more diverse than most kinds, showing individuals of upright and spreading or decumbent habits of growth, next to one another, and having a greater diversity in flower-colour than prevails in ordinary lucerne.

In the various types of lucerne one of the main points of difference is in root-structure. In all kinds there is a tendency towards the single long tap-root, and in most cases there are few lateral or spreading roots. In some, however, the tap-root is not so prominent, there being many branching or spreading roots. Amongst the latter type is Grimm lucerne.

It is contended that, from the standpoint of root-structure, the type of lucerne should be adapted to the soil in which it is to be grown. For the long tap-root variety the deep well-drained loam or shingle makes an ideal soil, whereas for a land having a compact subsoil or hard-pan the branching-root varieties are considered to be the most suitable.

An interesting feature of this spreading-root type of lucerne is that the crown in most cases grows under the level of the surface soil, and the buds start from the side instead of the top of the crown. It therefore bids fair to be a lucerne that can be more readily pastured by

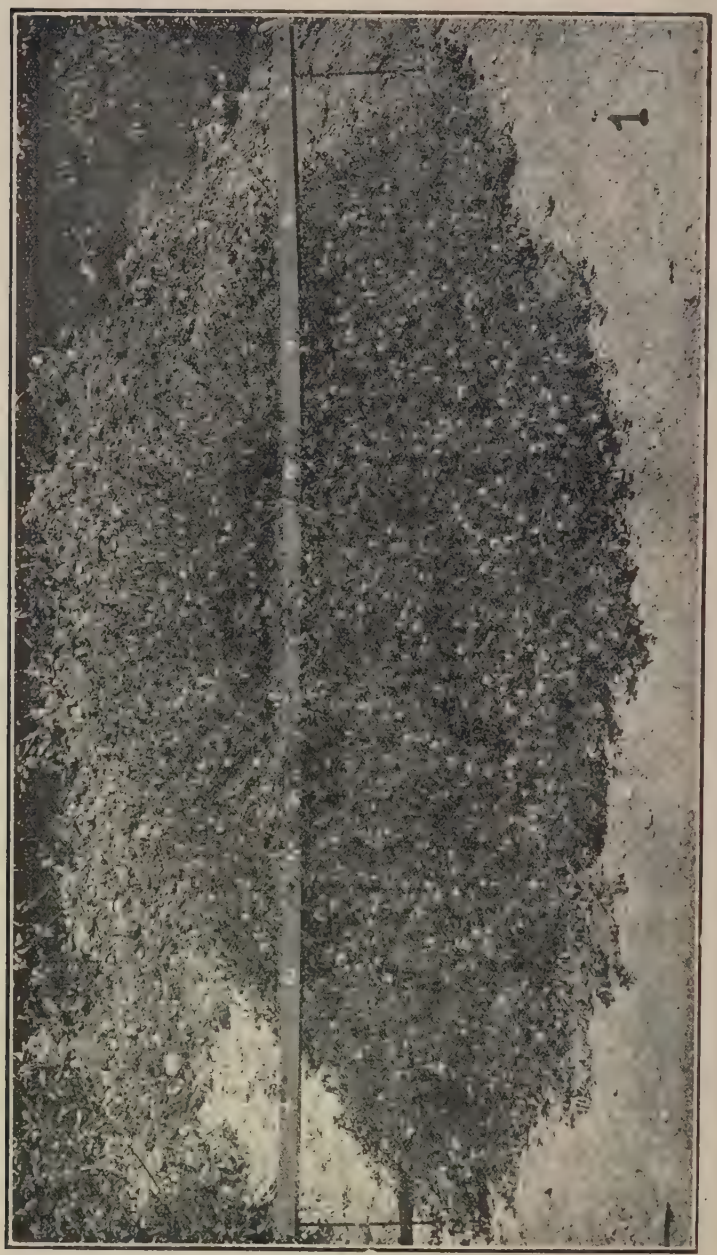


FIG. 1. PLANT OF GRIMM LUCERNE GROWN AT THE DEPARTMENT'S DEPOT, CHRISTCHURCH. (SEE OPPOSITE PAGE.)

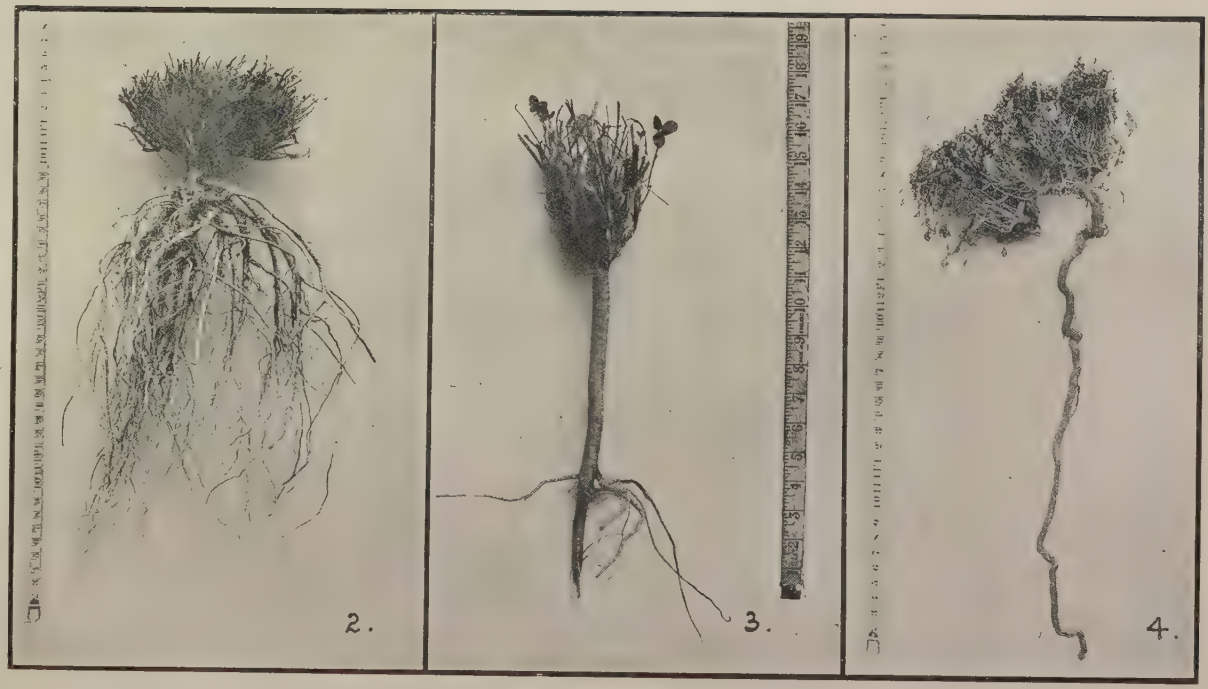
stock without injury to the plant; the crown being deeper in the ground than that of the long tap-rooted kinds prevents stock from eating too close to the crown, and the trampling of stock is not so likely to injure the young shoots or buds.

EXPERIENCE IN NEW ZEALAND.

Both in the United States and Canada the supply of genuine Grimm lucerne seed is very limited, consequently the price charged is high. In 1913 2 grams of the seed was secured from America by the Department, and was sown in a small isolated plot on the Morven Hills experimental area, in Central Otago, for testing and seed-production. After the seed was sown a change of officers in control of the area took place, and the value of the test was unfortunately overlooked. The plot was turned in before the plants had time to develop, and a root crop was grown and harvested; but despite this treatment seventy-six plants survived. These were dug up early in October, 1916, a length of only 9 in. of root being taken with each plant, and the adhering soil removed. The plants were put up in bundles, and were sent to the Department's depot at Christchurch, where they were exposed to the drying influences of air and sunshine. Nineteen days after the plants were dug up they were distributed to various places in the South Island and replanted, being previously steeped in cold water for twelve hours. All the plants survived and produced a vigorous growth during the year. The majority of those planted in Canterbury and Otago were again dug up last spring and transplanted for seed-producing purposes, in rows 3 ft. apart and 2 ft. between plants in the row. The plants came away more vigorously than ever. On account of the spreading or decumbent habit of growth of many of the plants the space allotted to each was found to be just right for successful seed-production.

A further small supply of Grimm lucerne seed was obtained in 1916, and a plant from a sowing made in November of that year at the Department's depot in Christchurch is shown in the illustration (Fig. 1). It was intended to secure seed from this plant during the first season, but a heavy fall of rain at the flowering-period caused a continuation of bloom and started a second growth. It was useless to expect a successful seed crop under such conditions, and the growth was therefore cut. The age of the plant when photographed was fifteen months. The growth was the second of the season and measured 9 ft. 3 in. in diameter or spread. The longer stems averaged 75½ in., and the weight of the growth was 16 lb. The soil in which the plant grew is a sandy loam on a sandy-clay subsoil. No inoculated soil, lime, or fertilizers were applied, nor did the plant receive special treatment of any kind except that the soil around it was cultivated to destroy weeds. After a third cut was obtained the plant was dug up in May, again photographed, and transplanted in fresh soil.

This photograph (Fig. 2) shows the extraordinary branching or spreading root-growth of the plant. Although only 3 ft. of the length of the root-growth is shown, it is quite probable that the roots had tapped the lower strata to a depth of 15 ft. or 20 ft. The neck of the root measured 4 in. circumference and the crown of the plant 16 in. diameter. As a comparison the photograph (Fig. 3) of a plant of the variety commonly known as Marlborough, the seed of which was sown on the same date as that of the Grimm, and in the same soil, is shown



VARYING TYPES OF ROOTS AND CROWNS IN LUCERNE.

Fig. 2. Grimm lucerne (same plant as Fig. 1). Fig. 3. Plant of Marlborough lucerne. Fig. 4. Lucerne-plant (variety unknown) from a 25-year-old stand. (See pages 21 and 23.)

to illustrate the single long-tap-rooted type. The circumference of the root under the crown of this plant measured just under 2 in., and the crown had a diameter of 5 in. Another plant of the single long-tap-rooted type from a stand twenty-five years old is also illustrated (Fig. 4). It is contended that the more branching the roots of a lucerne-plant the greater the length of stem produced.

CERTIFICATE-OF-RECORD COWS.

THE NEW ZEALAND MILK- AND BUTTER-FAT CHAMPION.

By W. M. SINGLETON, Assistant Director of the Dairy Division.

IN the February *Journal* New Zealand's highest milk-record and the leadership in butter-fat for the Friesian senior four-year-old class were noticed as having been won by Woodcrest Johanna Tehee, imported and developed by Mr. John Donald, of Westmere. The honours of the milk-record have not long rested with Tehee, for now a herd-mate, Westmere Princess Pietertje, has come forward with a production which eclipses the previous record by a wide margin.

Westmere Princess Pietertje has finished her 365-day test, and won a certificate on the following record: Age at commencement of test, 4 years 156 days; milk, 24,199 lb.; butter-fat, 939·78 lb. This record confers on her the New Zealand championship for milk- and butter-fat production for all classes and all breeds. The writer knows of no cow outside of the United States of America which has equalled this butter-fat record.

Our former highest butter-fat-record cow was Manor Beets Daughter II of Ashlynn, with a credit of 863·51 lb. fat, in the Friesian senior three-year-old class. With Westmere Princess Pietertje's achievement Mr. Donald has the credit of having bred two and developed three class-leaders (Friesians), as follows:—

Class.	Name.	Milk. lb.	Fat. lb.
Junior 4-year-old ..	Westmere Princess Pietertje ..	24,199·0	939·78
Senior 4-year-old ..	Woodcrest Johanna Tehee ..	21,483·1	754·95
Senior 2-year-old ..	Netherland Princess IV	19,621·6	805·77

Westmere Princess Pietertje is from Netherland Princess by Paul Pietertje. The dam was all Longbeach blood, while the sire was bred by Mr. Newton King from strains imported from the United States. These particular strains have "nicked" well, as is further evidenced by the fact that Netherland Princess IV, the best senior two-year-old, is a full sister to our new champion.

Westmere Princess Pietertje carried her calf during 247 days of her 365 days on test, and was never milked more than three times daily. These circumstances make her production compare favourably with a number of higher butter-fat figures in the United States produced on four-times-a-day milking and without regard to previous and subsequent calving.

Our new champion dropped her first calf at 1 year 8 months old, and started her present test at the age of 4 years 5 months, after her

fourth calving. It should be noted that she has been in profit each year. Despite the fact that she dropped her first calf while too young, she has grown into a large cow. Her length is greater than that of the old matron Domino III. She has a good measurement for heart-girth, and from hip to pin-bone. Her height at the shoulder is much above the average, due in part to the spinal column being raised above the level of the shoulder-blades. The prominence of this backbone and its open vertebræ with the cow in good working-condition would be pleasing to some good judges of special-purpose dairy cattle. A broad muzzle, a large body (due to its exceptional length, with a corresponding spring of rib), and a well-developed udder are evidences, even to the uninitiated, that Westmere Princess Pietertje has the physical development for her work. Her dairy temperament is evidenced by her production, as well as by the possession of large prominent bright eyes, a wedge-shaped clean-cut appearance, and a spinal column that is strong evidence that hers is the nervous temperament so desired in a dairy animal.

Westmere Princess Pietertje has been most consistent throughout her year on test. That her yield from day to day has varied so little is a great tribute to Mr. Donald's method of feeding and handling his cow throughout such a period of heavy production. Further, the champion seems to look as fresh as ever, and the writer believes she could again prove her claim to a 900 lb. butter-fat record.

EXPERIMENTAL WORK AT RUAKURA APIARY.

[On the transfer of the technical control of the Apiary at the Ruakura Farm of Instruction to the Horticulture Division of the Department arrangements were at once made for the general supervision to be under Mr. G. V. Westbrooke, Apiary Instructor for the district. The Department was fortunate enough to secure the services of Mr. A. B. Trythall as Apiarist in Charge. The following is the first general report on the experimental work of the apiary, and is furnished by Mr. Westbrooke in consultation with Mr. Trythall.—*T. W. Kirk, Director of the Horticulture Division.*]

LAYING OUT AN APIARY.

The usual method is to lay out in rows, hives 8 ft. and rows 10 ft. apart. It is noticeable that when the apiary contains about eighty to a hundred colonies there is considerable mixing-up amongst the bees. Outside hives often become stronger at the expense of the centre ones. Different methods were tried at Ruakura, such as groups of five and three hives. The disadvantage of this system is that if one has occasion to divide the hives the groups become crowded or involved, and the conclusion we have come to is that the arrangement of hives is largely a matter of individual taste and method of management.

VARIOUS TYPES OF HIVES AND ACCESSORIES.

"*Waters*" *Hive.*—This hive is not likely ever to become popular, as it is difficult to handle, being so large; moreover, as all the entrances are to the front the bees have a tendency to go to one entrance. It could be improved by having the entrances to the end apartments at the sides.

Twelve-frame "Langstroth" Hive.—This is a really good hive for our mild climate, especially in the North Island, and it can be recommended to any one making a start. But for the average beekeeper shallow supers only should be used with this type, as otherwise they would be too heavy to lift. The frames for this hive being "Langstroth" are interchangeable with those of the ten-frame hive of the same name. The New Zealand climate, with its mild winter and long spring, favours a large brood-nest, and the twelve-frame hive thus has an advantage over the ten-frame. The disadvantages are that the former is rather heavy to lift, and is itself not interchangeable with the ten-frame hives or supers.

"Dadant-Quinby" Hive.—This hive is quite unsuitable for New Zealand conditions, as it is too heavy and clumsy, and the double-walled supers are not necessary in this climate. It is off the standard size in frames and hive-parts, and would need a special extractor and comb-foundations, thus meaning extra expense.

"Danzenbaker" Hive.—This is also unsuitable for New Zealand, as it is much too small and not of standard size. The "Danzenbaker" comb-honey supers, with their 5 in. by 4 in. sections, in our opinion are an improvement on the New Zealand pattern, and as they are interchangeable with ours they can be recommended.

"Deadman" Super-cleaner.—A trial was given this past season of the drip-comb super-cleaner, and proved one of the best experiments carried out at the apiary. It is an excellent device for cleaning combs after being extracted; it prevents robbing and attendant evils. [This device was described by Mr. Trythall in the *Journal* for April last.]

Fence Separators for Sections.—These are good, and an improvement to the old-pattern tin separators.

Metal-spaced Frames.—We have given the metal spacers for frames a trial, and are of the opinion that though they strengthen the frame and offer less surface for the accumulation of propolis the disadvantages outweigh the advantages. They take more time to fix, are more expensive, and are more difficult to handle.

Hive-covers.—American-pattern flat roofs are liable to be blown off, and are not recommended. The flat telescopic zinc-covered roof is highly satisfactory in every particular, is easily made, and absolutely dry. It is very durable, easily packed for storage, is removable, and is superior to all other makes.

Bottom-boards.—The American-pattern floor-board is fair, but could be greatly improved if it had a good entrance-contracting device.

"Hand" Bottom-board.—During the season the Hand bottom-board was given a good trial, and it has been proved to be an excellent device in securing almost perfect control over swarming. It lends itself to so many different manipulations that it will possibly solve many of the beekeeper's difficulties. Some fifteen hives were set apart to fully test this system, with the result that it can be confidently recommended to careful beekeepers.*

Shallow Honey-supers.—These are past the experimental stage, and are an improvement on the full-depth type. They are light and easy

* An article by Mr. Trythall giving a full account of the Hand system will be published in next month's *Journal*.

to handle, and the bees ascend to them more readily. They are easy to extract, and a boon to women beekeepers.

Frame-wiring Devices.—We have found Doyle's frame-wiring block a very useful appliance, and the Stephen Anthony frame-block for putting together frames is a decided success.

Hive-stands.—The "Eternite" stands, on which are placed the bottom-boards in the apiary, are lasting well, and keep down the grass with a minimum of labour.

HONEY APPARATUS.

Gravity-straining Honey-tank.—This saves much waste in honey, time, and labour, and does good work.

Steam-heated Uncapping-knife.—This is a great help at extracting-time, and fulfils all its claims, and once used would never be abandoned.

HIVE-RECORDS.

Weight.—We have had two hives on scales throughout the year, and the following are the results:—

Hive No. 1.

1917.		lb.		lb.	Remarks.
April 1.	Total weight of hive	92			
,, 30.	,,	87	Decrease	5	
May 31.	,,	84	,,	3	
June 30.	,,	80	,,	4	
July 31.	,,	78	,,	2	
Aug. 31.	,,	68	,,	10	Owing to brood-rearing.
Sept. 30.	,,	77	Increase	9	Owing to daily feeding.
Oct. 31.	,,	71	Decrease	2	In spite of daily feeding.
Nov. 30.	,,	105	Increase	30	
Dec. 31.	,,	134	,,	29	
1918.					
Jan. 31.	,,	179	,,	35	
Feb. 28.	,,	109	..		Honey removed, 70 lb.
Mar. 31.	,,	107	Decrease	2	

The largest quantity of honey gathered in any one day of November was on 4th November, 4 lb.; of December was on 5th December, 5 lb.; of January was on 3rd January, 4 lb.

Hive No. 2.

1917.		lb.		lb.	Remarks.
April 1.	Total weight of hive	84			
,, 30.	,,	79	Decrease	5	
May 31.	,,	76	,,	3	
June 30.	,,	73	,,	3	
July 31.	,,	70	,,	3	
Aug. 31.	,,	66	,,	4	
Sept. 30.	,,	77	Increase	11	Owing to daily feeding.
Oct. 31.	,,	76	Decrease	1	In spite of daily feeding.
Nov. 30.	,,	120	Increase	44	
Dec. 31.	,,	139	,,	19	
1918.					
Jan. 31.	,,	147	,,	8	
Feb. 28.	,,	112	..		Honey removed, 35 lb.
Mar. 31.	,,	110	Decrease	2	

Largest quantity of honey gathered in any one day of November was on 29th November, 5 lb.; of December was on 28th December, 2 lb.; of January was on 3rd January, 1 lb.

Temperature.—A record of the temperatures has also been kept, the readings being taken daily at 9 a.m., noon, and 5 p.m. The following are the highest and lowest temperatures (Fahrenheit) recorded for each month:—

Month.	Temperature on any One Day.	9 a.m.		Noon.		5 p.m.	
		Upper Story.	Lower Story.	Upper Story.	Lower Story.	Upper Story.	Lower Story.
1917.							
April ..	Highest	80	84	80	84	82	86
	Lowest	64	64	68	74	70	70
May ..	Highest	86	64	86	68	86	67
	Lowest	60	42	68	52	59	50
June ..	Highest	85	62	86	64	85	64
	Lowest	76	42	78	52	72	51
July ..	Highest	89	72	90	70	90	82
	Lowest	74	40	75	52	72	51
Aug. ..	Highest	93	68	95	76	95	74
	Lowest	90	59	90	60	89	58
Sept. ..	Highest	94	84	96	90	96	90
	Lowest	91	70	92	73	92	71
Oct. ..	Highest	94	90	95	92	94	94
	Lowest	92	86	93	90	90	78
Nov. ..	Highest	98	92	96	94	95	95
	Lowest	92	84	86	91	93	86
Dec. ..	Highest	96	93	95	93	94	95
	Lowest	90	90	90	90	91	89
1918.							
Jan. ..	Highest	93	90	94	92	94	92
	Lowest	88	88	86	89	89	89
Feb. ..	Highest	92	90	93	90	93	90
	Lowest	79	83	72	86	83	84
Mar. ..	Highest	80	88	78	88	88	89
	Lowest	71	81	70	82	72	84

WAX-PRODUCTION.

An experiment is now in progress to ascertain the quantity of wax that can be produced by a hive worked for that purpose only. This test is not yet sufficiently advanced to report on.

Storing Kumaras.—A correspondent at Onerahi, North Auckland, writes, "I raise quite a few kumaras every season, and for the past three years I have packed them in ordinary sawdust, just enough to keep each one apart from the next. Of course, I have my kumaras dry, and also the sawdust. I then keep them in a dry, semi-dark basement. My boxes are about 4 ft. x 3 ft. x 2 ft. 6 in. I never have more than a dozen spoiled kumaras in the season, and keep them right up to the time that kumaras are ready again." Another North Auckland correspondent writes to the same effect, and states that the Natives are also adopting the sawdust-packing method in place of the old system of *ruas*.

PRIMING OF TABLE COCKERELS.

DEMONSTRATION AT CHRISTCHURCH.

By F. C. BROWN, Chief Poultry Instructor.

THAT a large majority of cockerels reaching the market are of inferior quality, especially as regards condition, is well known to any one actually interested in the table-poultry trade. Owing to this fact the price usually realized for cockerels is unsatisfactory to the producer, while the birds are equally unsatisfactory to the poulterer and consuming public. Neglect on the part of poultrymen to feed and handle their surplus cockerels to the best advantage must mean an annual loss to the industry of several thousand pounds, and to prevent this economic waste there is need for great reform in the methods adopted by the producers. There is always a keen demand and high prices for well-primed birds; on the other hand, poor-conditioned stock are disposed of at practically begging-prices.

With a view to bringing under the notice of poultry-keepers the money lost through failure to market their birds in a proper manner the Department has conducted two priming-tests. The first was carried out during April and May, 1916, full particulars being published in the July issue of the *Journal* for that year. In this test a number of inferior cockerels were purchased by the Department under competition at one of the weekly poultry sales at Christchurch. The birds were taken in hand and given a plain priming-diet for twenty-four to thirty-one days. They were then again offered at the same auction-mart, and returned, after deducting cost of feeding, a profit of 92 per cent.

The second test commenced on 22nd April last, with sixty birds, and was continued until 18th May. As in the previous test, the birds were purchased under competition at a weekly auction, and after twenty-six days they were again sold at the same auction-mart. In this case the birds which took part ranged from four and a half to five and a half months old, and, generally speaking, were of much superior quality to those purchased for the 1916 test. Notwithstanding that top prices were paid for some of the birds, it will be seen by the tabulated results that a profit of 19 per cent. was made on the experiment over and above the cost of food and after deducting the cost price of two birds destroyed. This clearly indicates that the condition of even the better birds seen in the market is not what it should be. To demonstrate this fact was the chief object in purchasing good store cockerels for the second test. It was realized at the outset that the birds would not make the same gain in weight as was the case with the much poorer birds in the first test.

It may be mentioned that these tests were not carried out with a view to encourage the buying of store birds at auction-sales for the purpose of priming, but rather to induce farmers and others to devote more interest to this branch of their business. Buying mixed lines of

poultry at auction with a view to improving their quality is always a risky business, on account of the liability of introducing infectious disease into the flock. As an instance, at the end of the second week of the test under review two birds developed chicken-pox, while three contracted colds, notwithstanding the fact that no birds had been kept in the quarters used for over a year. The two former birds were destroyed, whilst the latter were isolated and took no further part in the test.

It is probable that the price realized for the birds after priming could have been obtained by the producer in the first place, at no additional cost, had they been fed and managed in a proper manner. It stands to reason that the knocking-about during transit and the number of handlings, together with the change of food and quarters which the birds were subjected to, was all against flesh-production.

The test was in charge of Mr. C. Cussen, Poultry Instructor, Christchurch, to whom any credit for its success is due.

PRELIMINARY PROCEDURE.

As in the first test, and before the priming process commenced, the birds were given Epsom salts and sulphur, this being for the purpose of clearing the intestines of any internal parasites and putting the birds in a healthy condition generally, so that the food consumed would be put to the best use. This is an important matter if the best results are to be obtained. One packet of salts was allowed for every twelve birds, and was dissolved in the water with which the mash was mixed. The sulphur, about the same amount as the salts, was added to the dry formula of crushed grains, &c., the whole being thoroughly mixed before moistening.

In order to free the birds from vermin (which was numerous) they were carefully dusted with equal parts of carbolic powder and sulphur before the test commenced, and again a week later. Some of the birds were badly affected with scaly-leg, and were twice treated with a mixture of kerosene, sulphur, and lard, which soon had the effect of removing the trouble.

DIETARY AND MANAGEMENT.

For the first ten days (commencing on 22nd April) the morning mash consisted of ground oats, 54 lb.; ground wheat, 54 lb.; ground peas, 27 lb.; salt, 2 lb.

A midday mash was given as follows: Ground oats, 65 lb.; wheat-meal, 65 lb.; meat-meal, 12 lb.

As much as the birds could eat was given at each meal. The evening meal consisted of whole wheat. After ten days the latter (midday) mash was supplied for both the morning and evening meals. In addition, dry crushed wheat and pea-meal was supplied in separate receptacles, and always left before the birds for them to pick at.

On 10th May it was observed that the birds did not appear to relish their food, and for this reason the ration was changed. From that date to the end of the test (18th May) a mash made up as follows was fed night and morning: Pollard, 25 lb.; ground oats, 15 lb. (with husks sieved out); wheat-meal, 30 lb. In addition, 3 lb. to 4 lb. of boiled potatoes were added at each mixing, and during the last week also

about ½ lb. of melted fat. In every case the mash was moistened with hot water.

Unfortunately, skim-milk was not available for this experiment. It was used in the first test, and is an excellent material for mixing a mash and making it appetizing, while for drinking purposes there is nothing to equal it. No doubt the results would have been better had milk been procurable. Ground maize was unobtainable in Christchurch, and pea-meal was tried as a substitute, but its use was discontinued, as the birds did not take to it.

Another point worthy of mention is that whereas in the first test ground hulled oats were used, in the second test ordinary ground oats were fed. After the second week the latter were sieved in order to eliminate from the mash as many husks as possible. This had a most desirable effect, the birds eating the mash much more greedily than when the husks were included.

Gravel, grit, charcoal, and clean water were always before the birds, while green food, chiefly cut grass and clover, was supplied daily.

TABULATED RESULTS.

60 Cockerels purchased at Auction, 20th April.

		£	s.	d.
3½ pairs at	6/11	1	4	3
2 ,,	6/0	0	12	0
3½ ,,	5/9	1	0	2
4 ,,	5/6	1	2	0
3 ,,	5/4	0	16	0
2 ,,	4/10	0	9	8
2½ ,,	4/5	0	11	0
2 ,,	4/4	0	8	8
1½ ,,	4/3	0	6	5
3 ,,	4/1	0	12	3
3 ,,	3/10	0	11	6
		£7	13	11

55 Cockerels sold at Auction, 18th May.

		£	s.	d.
7½ pairs at	10/0	3	15	0
4½ ,,	9/9	2	3	10
4 ,,	9/3	1	17	0
3½ ,,	9/0	1	11	6
2 ,,	8/9	0	17	6
6 ,,	8/0	2	8	0
		£12	12	10

	£	s.	d.
Cost price of 60 cockerels	7	13	11
Food-cost of priming	3	8	10
	11	2	9
Less three birds unsold	0	11	2
Cost of food consumed and purchase-cost of 57 birds, including 2 destroyed	10	11	7
Proceeds from sale of birds	12	12	10
Profit (equalling 19 per cent.)	£2	1	3

NOTE.—No reduction has been made for food eaten by the two birds destroyed and the three not sold.

	lb.
Average weight of birds when bought	3·7
Average gain per bird	1·8
Average weight when sold	5·5

FOOD POINTS.

Comparing notes of observations made during the two tests the following are some of the conclusions arrived at :—

Where possible, milk, as also ground maize, should be included in a priming-ration.

Ground hulled oats are preferable, even at a much higher cost, to ordinary ground oats.

Foods containing a high percentage of fibrous or husky material are unsuitable generally.

Pea-meal is unsuitable for priming purposes.

When birds go off their food owing to restricted exercise a change of appetizing diet is essential to obtain best results.

Only concentrated foods of good quality should be used.

IMPORTATION OF FERTILIZERS.

ANNUAL RETURNS.

By B. C. ASTON, F.I.C., Chemist to the Department.

THE returns of artificial fertilizers imported into New Zealand during the year ended 31st March, 1918, are now, by the courtesy of the Comptroller of Customs, available for the accompanying tables. These, as usual, are designed to show the returns of the twelvemonth compared with those of the previous corresponding period.

The following is a summary of the kinds, quantities, and values of the various fertilizers imported during the years ended 31st March, 1918 and 1917:—

	Weight.		Value.	
	Year 1917-18.	Year 1916-17.	Year 1917-18.	Year 1916-17.
	Tons.	Tons.	£	£
Bonedust	6,363	10,386	41,898	60,769
Bone char	676	500	3,403	2,163
Bone and blood	26	750	360	5,227
Basic slag	10	6,660	43	19,931
Egyptian basic phosphate	11,225	8,614	43,217	33,157
Superphosphate	37,157	31,962	185,515	137,499
Guano and rock phosphate	37,037	24,993	66,882	46,621
Phosphate unspecified	..	251	..	1,010
Sulphate of potash	25	..	825	..
Potash salts unspecified	..	9	..	359
Gypsum	564	9,830	902	10,020
Sulphate of ammonia	65	249	1,731	5,001
Nitrate of soda	34	645	602	8,952
Calcium cyanamide	..	65	..	844
Sulphate of iron	54	70	380	378
Manures unspecified	..	86	..	280
Totals	93,236	95,070	345,758	332,211

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS TO NEW ZEALAND FOR

New Zealand Port of Entry.		Australia.					Belgium.			Germany and Austria.					Holland	
		Nitrogenous Manures.	Bonedust and Blood and Bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Gypsum.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Phosphate unspecified.	Potash Manures.	Superphosphate.	Basic Slag.
Auckland ..	1918	10	997	1,250	359	50	..	..	..	..	..	..	..	..	..	..
„ ..	1917	56	1,406	4,789	583	420	..	..	..	..	..	..	..	..	..	..
Tauranga ..	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	390	..	..	..	..	..	..	..	..	..	..	..	..
Poverty Bay ..	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Plymouth ..	1918	..	..	1,907	335	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	1,477	230	20	..	..	..	..	..	..	..	..	..	..
Patea ..	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..
Wanganui ..	1918	..	..	2,268	..	414	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	1,898	1085	810	..	..	..	..	..	..	..	..	..	..
Wellington ..	1918	22	244	6,992	17	16	..	..	..	..	..	..	..	..	..	..
„ ..	1917	5	..	3,041	761	1,786	..	..	..	..	..	..	..	..	..	..
Napier ..	1918	..	..	280	102	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	3	..	250	100	60	..	..	..	..	..	..	..	..	..	..
Wairau and Picton	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	1917	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nelson ..	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	302	..	..	..	..	..	..	..	..	..	..	..	..
Lyttelton ..	1918	..	..	7,848	688	77	..	..	..	..	..	..	..	..	..	..
„ ..	1917	20	..	4,670	1275	4,532	..	..	..	..	..	..	..	..	..	..
Timaru ..	1918	..	..	3,569	645	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	1,795	1661	1,850	..	..	..	..	..	..	..	..	..	..
Oamaru ..	1918	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunedin ..	1918	30	..	2,941	982	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	5	65	707	805	300	..	..	..	..	..	..	..	..	..	..
Invercargill ..	1918	25	492	7,049	..	..	..	..	..	..	..	..	..	..	..	..
„ ..	1917	170	650	5,937	699	..	..	..	..	..	..	..	..	..	..	..

* Also 25 tons sulphate of potash to Wellington.

YEARS ENDED 31ST MARCH, 1918 AND 1917, SHOWING COUNTRIES OF DEPARTURE.

India *	Japan.	Pacific and Indian Ocean Islands.		Scandinavia.	United Kingdom.						United States.		Egypt.
Bonedust.	Superphosphate.	Name of Islands.†	Rock Phosphate.	Calcium Cyanamide.	Nitrogenous Manures.	Superphosphate.	Basic Slag.	Potash Manures.	Phosphate unspecified.	Iron Sulphate.	Nitrate of Soda.	Iron Sulphate.	Basic Phosphate.
3,344	554	Makatea Island	18,112	..	..	..	..	..	..	..	..	..	2,750
		New Caledonia	1,543										
		Society Islands ..	250										
7,405	901	*New Caledonia*	2,037	..	..	..	3,452	..	27	..	..	..	2,016
		Makatea Island	8,273										
		Seychelles Islands ..	545										
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
40	..	..	..	..	..	..	..	..	..	..	..	..	..
85	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
350	..	New Caledonia	2,925	..	..	..	..	..	..	2	..	..	3,475
400	..	..	..	61	..	1,757	3,033	..	..	..	..	..	3,050
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	*New Caledonia*	301	..	..	..	25	..	..	..	..	..	..
..	2,499	..	..	..	..	..	..	..	..	..	..	46	.
65	..	..	..	..	..	1,989	150	..	..	53	..	..	.
80	..	..	..	..	..	..	..	..	..	..	..	..	.
..	2,056	..	..	..	..	3	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	..	..
500	..	Makatea Island	4,050	..	..	..	..	..	..	..	..	..	2,500
325	..	.. „	2,462	..	..	..	..	..	..	..	..	13	1,048
1,025	..	New Caledonia	3,039	..	..	..	..	..	..	..	..	..	2,500
		Makatea Island ..	4,000										
785	..	*Makatea Island*	1,475	..	..	..	..	..	..	..	..	..	2,500

† In previous returns Makatea Island has been shown under the designation Tuamotu Archipelago.

The declared import values per ton of the chief phosphatic and soluble nitrogenous fertilizers for the two years under review work out as follows:—

	Year ended 31st March, 1918.	Year ended 31st March, 1917.
	£ s. d.	£ s. d.
Bonedust	6 12 0	5 16 0
Basic slag	4 6 0	3 10 0
Egyptian phosphate	3 17 0	3 17 0
Superphosphate	4 19 6	4 6 0
Guano and rock phosphate ..	1 17 0	1 17 6
Nitrate of soda	17 15 0	13 17 6
Sulphate of ammonia	26 12 6	20 1 6

One might dilate largely in discussing these figures, and draw some interesting facts from almost every item did space permit. On the whole, however, the inferences to be drawn are fairly obvious, and the writer will content himself with referring to some of the more obscure points. It has been suggested that the production of fertilizers from phosphate rock mined in the Dominion is a factor affecting the importation of phosphates, but this idea will not so far stand a moment's examination, as the empty sheds of fertilizer-manufacturers at the end of a season and the good prices obtained compared with the declared value testify. In spite of the general increase in prices the importation of phosphatic fertilizers has greatly increased. The almost neutral or acid phosphates, such as ground rock phosphate (guano) and superphosphate, are to be credited with this increase; while the alkaline or mildly alkaline phosphates, such as basic slag, bonedust, and blood and bone, show a comparatively large decrease. One could view these figures with more equanimity could it be proved that sufficient amounts of locally produced carbonate of lime or quicklime were being used on the lands to which the acid or neutral fertilizers were being applied, so as to ensure the maximum efficiency of the latter. It will be noted that in spite of the shortage of shipping those phosphate islands of the Pacific which produce a high-grade rock show greatly increased exports to New Zealand. Egyptian basic phosphate has evidently come to stay, the imports having jumped up from 2,000 to 11,000 tons in three years. Altogether the phosphate returns show a considerable improvement on those for the previous year.

As regards potash, the importation of even 25 tons from India is interesting as indicating a new country of origin. It is to be hoped, however, that the waste of potash now going on in the Dominion may be stopped. If potash is necessary it may be supplied more cheaply from local sources than by paying the price now asked (about £1 per unit K_2O) for the manurial salts.* Field experiments will alone give the convincing answer to the potash problem in New Zealand.

* The author's note in last month's *Journal*, page 353, asking for offers for wood-ashes, of which a surplus promises to become available, is still without adequate response from agriculturists or fertilizer-merchants.

Boiled potatoes do not contain much of the elements that tend to promote egg-production, and should therefore be excluded from a laying-hen's diet, or only sparingly included.

THE GRASS-LANDS OF NEW ZEALAND.

(Continued.)

By A. H. COCKAYNE, Biologist.

SPECIAL PASTURES—PASPALUM; PRAIRIE-GRASS.

SPECIAL pastures are those that act more or less like grass supplementary crops in tiding over the crucial periods of the general grass-land. Temporary pastures, and especially clovers sown with cereals and ploughed up the following winter or spring, can be looked upon as special pastures. I, however, like to restrict the term to special paspalum and special prairie-grass paddocks. The former act as a summer supplementary crop, and the latter as a winter one.

Whether or not paspalum should be sown in general pasture mixtures is a matter for careful investigation, but the value of paspalum as a special permanent summer forage crop and grown on special areas specifically for this purpose admits of no argument. The subject was fully dealt with in an article by the writer on "Paspalum in New Zealand," published in the *Journal* for February last, and need not be repeated here.

Special paddocks of prairie-grass should fulfil a very important function in affording large quantities of succulent winter feed. Their chief objection is that if grazed hard during the first year they are very apt to be eaten out. Many farmers consider that the time necessary to establish prairie would be better employed in growing Italian rye-grass. This, however, is a matter for experiment, and until the relative cost of production of prairie and Italian are worked out any such statement is merely surmise. Another point that is overlooked in laying down prairie-grass is the small number of seeds per pound (under 50,000). This means that the seeding should be heavy, certainly not less than 75 lb. per acre. In laying down prairie-grass paddocks a mixture of prairie (75 lb.) and red clover (6 lb.) should be used. The seed should be sown at the end of March, and only very lightly stocked until the following November, when it should be shut up for hay. A light cutting of mixed prairie and clover hay could be secured about Christmas-time, and the paddock should then be again shut up for hay. In the second winter it can be periodically grazed with dairy cows, and in the summer used for soiling or haying the red clover. This practice can be followed until the clover disappears, when the stand will be pure prairie, and will give large yields of winter feed each year. Under no circumstances should sheep graze on prairie-grass paddocks until after the second or third year.

SEEDING OF PLOUGHED GRASS-LANDS.

Any seeding that takes place before the new year is termed "spring sowing," and any seeding after the new year "autumn sowing." Practically, however, there are three distinct seasons when grass-seed is sown: (1) In the early spring, along with cereals, or in a spring culti-

vation of winter-sown cereals; (2) along with rape in November; (3) with or without a winter annual cereal in the autumn (March–April).

The late spring sowing (with rape) is very popular, but the total area in rape is not sufficient for the purpose. Roughly, there are 220,000 acres of rape sown each year, and a very much greater area than this is annually sown down in short-rotation grass-land alone. Personally, I am not in favour of seeding with a crop, though the cheapness of this method has made it very popular. Even at the present time grass-land does not occupy the true position that it ought, and special preparation of the ground specifically for grass is rarely undertaken. Cheapness of establishment is the great point aimed at, and in many cases this turns out expensive in the long-run.

In laying down grass-land in the autumn the mixture is often sown with what is termed a covering-crop, such as barley or oats. The cereal is used to increase the quantity of feed produced within the first month or two after sowing. This practice may be sound in certain cases, but in general much better and usually cheaper results are secured by using Italian rye-grass as the temporary ingredient in any mixtures. On certain soils, again, the use of a temporary grass in leas of long duration is bad, but our knowledge on this point is not sufficient to allow us to dogmatize. A pasture, for instance, in many cases is made to act as an annual forage crop, a temporary pasture, and finally a pasture of long duration. Theoretically all these can be combined, the less durable species giving place by degrees to the more permanent elements. In many cases such does take place, but there is much evidence to show that excessive development of temporary ingredients in a long-duration pasture causes a poor development of the permanent elements.

This subject is a very important one, and it has been suggested that in many cases pastures should be laid down largely only with one species, and act only as special seasonal pastures, just as is being done with paspalum. The objections, however, to the single-species grass-land are many, and such a procedure, in my opinion, should only be attempted where mixed pastures definitely fail.

SURFACE-SOWN GRASS-LANDS.

The original vegetation that preceded our surface-sown grass-lands can be grouped under five distinct headings—(1) Natural grass-land; (2) forest; (3) scrub and shrub land; (4) fern (bracken heath); (5) swamp.

Very large areas of all these types of original vegetation have been converted into grass-land in the past, and much still remains to be dealt with. Surface-sown grass-land may remain untouched so far as intentional seeding or reseeding is concerned, but very large areas originally surface-sown have come under various cultivation methods. This is true of land originally incapable of being ploughed, but which has become so with the natural or artificial removal of stumps, logs, alterations in drainage, and other causes. In all cases, however, where topographical features preclude ploughing the only changes that take place are those influenced either by the special natural conditions of the environment or the artificial and controllable stocking-conditions set up by the farmer. The development of surface-sown pastures irrespective of cultivation is one of our most important phases of pasture investigation.

NATURAL GRASS-LAND AND ITS DEVELOPMENTS.

This type of natural vegetation consists of five different groups :—

Subalpine fell-field (the summer country of the mountainous sheep-runs of the South Island).

Montane-tussock grass-land (also the summer country of the mountainous sheep-runs).

Lowland-tussock grass-land (this comprised most of the lowlands of Canterbury and Otago, and the greater part of it is now used for rotation farming).

Tall-tussock grass-land (this was best developed in South Otago and Southland on the sour soils influenced by the subantarctic climate of the south of New Zealand).

Salt-meadow grass-land.

In no case were any of the natural grass-lands of a meadow type capable of being cut for hay. The striking characteristic of these grass-lands was the dominance of plants with a strictly xerophytic (drought-resisting) tussock-growth form, shown in the species of poa, festuca, and danthonia.

Virtually no attempts have been made to surface-sow the subalpine fell-fields, but stocking and burning have considerably modified them in many places, and a fair number of introduced plants have been established by these means.

Surface-sowing of the montane-tussock grass-land has never given any satisfactory results, but much of it has been considerably modified by stocking and burning. Much transition montane and lowland tussock in regions of fair rainfall have partly by stocking and partly by sowing become mixed with considerable proportions of European grasses and clovers, and in places *Danthonia pilosa* has become dominant. In regions of very small rainfall, notably in Central Otago, stocking and burning has in many cases completely destroyed the original vegetation, and a true desert type has taken its place. Such country is termed "depleted land."

Lowland-tussock areas on unploughable land have often been surface-sown, and where the land is of good quality a cocksfoot-ryegrass association has been developed between the tussocks. Very often, however, lowland tussock, irrespective of what grasses have been sown, has developed into *Danthonia pilosa* country. At times tussock (*Poa* spp.) persists, but often finally disappears, and is replaced by danthonia pure or mixed with certain grasses such as *Poa pratensis*, sweet vernal, cocksfoot, hair-grass, red-top, together with clovers such as white, suckling, clustered, scabrid, and haresfoot. Nearly all ploughable lowland-tussock area has, however, been turned into rotation farms, where short-rotation grass-land, or successional short-rotation grass-land, is the general type at the present day.

GRASS-LAND FROM FOREST.

Pasture developed on forested areas is given the general term of "bush-burn grass-land." Many millions of acres of pasture, especially in the North Island, are of this type, and they form the most important series of grass-land in New Zealand. Although all included under the one term, they vary in composition and behaviour more than any other types of pasture. They can all be termed permanent so far as intention is concerned, but they are subject to great succession

changes. In many cases these changes are kept in check by varying systems of management, but in others successions always occur, sometimes intentionally encouraged by management, and at other times avoided if possible. Much bush-burn country originally unploughable has now become capable of arable farming, but in many districts the finest and most productive pastures are derived directly from the original surface-sown mixture laid down on the ashes of the felled and burnt forest.

The great variation in the composition of bush-burn grass-land is not to be wondered at when one considers that the original vegetation, although of a forest character, was made up of a great variety of associations. This is, of course, only another way of saying that the edaphic (soil) and climatic conditions of bush-burn grass-lands are not uniform.

Before dealing in a general way with the bush-burn grass-land it will be well to enumerate the leading types of forest which they have replaced. These are—(1) Coastal forest; (2) rain forest; (3) transition rain beech forest; (4) beech forest. Rain forest is subdivided into a large number of groups, of which tawa forest, taxad (pine) forest, kahikatea forest, and kauri forest are the most important. Beech forest, again, from a grassing point of view is divided into two types—dry beech forest and wet beech forest, the latter being characterized by the abundant development of slowly decomposing raw humus or peat. This last-named type of forest is exceedingly difficult to grass permanently, and the work should not be attempted until such time as our practical knowledge regarding its proper management is considerably advanced.

In both Islands a very large extent of bush-burn pasture areas have proved unsuccessful, but in the majority of instances this has been due either to faults in the seed-mixture used or to faults in management. These latter, again, can in most cases be traced to an insufficiency of available capital. The large areas of unsuccessfully grassed bush-burns, reflected in the excessive development of undesirable vegetation, such as fern, manuka, wineberry, and blackberry, are often quoted against what is termed the "ruthless destruction of our forests." They certainly form a strong argument in favour of a definite forest policy, but when used as an argument against bush-burn farming the causative effects of failure should not be neglected.

The fact of the varying types of original vegetation emphasizes the necessity for great discrimination in the seed-mixture that is used. In many cases, on the poorer types of land, a seed-mixture suitable for better land is used, and does not endure permanently, serious deterioration often occurring. The period of the thinning-out of the original sowings and the entrance of other competing plants is the critical time when both useful and bad successions take place. Where bad successions are likely to arise seed of those grasses likely to compete successfully against objectionable vegetation are included in the original sowing. It is quite an arguable point whether the first sowing should not be specially designed to avoid succession, but in general a cocksfoot-ryegrass mixture yields such excellent growth during the first few years that it is a moot point whether an inferior-yielding mixture more likely to be permanent should be substituted. Very large areas of bush-burns on inferior country turn by skilful management from cocks-

foot-ryegrass to danthonia-cocksfoot, and although danthonia has numerous drawbacks it is probably the best type of permanent grass-land it is possible to develop on much of our inferior hilly land incapable of being ploughed.

The mixtures used on bush-burns vary considerably, but as a rule the whole of an individual area is sown with the same mixture. This is an unfortunate necessity largely due to transport difficulties. Very often when a large block—say, 1,000 acres—is sown, certain parts are very much better than others, and different mixtures really should be used. Occasionally when some of the ground is particularly bad it may be sown after the general seeding with some special seed, such as danthonia, Chewings fescue, or agrostis. If sown early in the autumn and the land is at all suitable, rape and turnips are included. Generally the whole lot is sown at once, but occasionally the rape and turnips may be sown first and the grasses and clovers later on. This, however, is only done where the country is easy, or when the grassing is delayed to secure the generally cheaper prices ranging for new season's seed.

When the burn has been quite satisfactory no further burning may ever be done, except on fairly level country, where logging-up and burning may take place some considerable number of years after the first burn. When the burn has been bad, burning off odd patches and sowing has to be done whenever opportunity affords. In beech country secondary fires are nearly always necessary.

The following are some more or less typical mixtures used on bush-burns. Nos. 1 and 2 represent kahikatea-forest seedings, Nos. 3, 4, 5, 6, and 7 ryegrass-cocksfoot and cocksfoot-ryegrass seedings on good to fair bush country, and Nos. 8 and 9 seedings on poor bush country. No. 10 is an Auckland sowing where paspalum is used.

	(1.)	(2.)	(3.)	(4.)	(5.)	(6.)	(7.)	(8.)	(9.)	(10
	Pounds per Acre.									
Perennial ryegrass ..	20	..	12	6	6	6	6	6	..	6
Italian ryegrass ..	3	10	3	3	3	..	..	..	..	..
Cocksfoot	3	5	5	12	12	12	12	14	14	12
Timothy	2	3	1	1	..	..	..	..	..	..
Crested dogstail ..	1	..	1	1	2	1	1	1	1	..
Meadow-foxtail	..	10	2	2	..	..	..	..	..	..
Poa pratensis	..	..	..	..	2	1	1	1	1	1
Poa trivialis	..	2	1	1	..	..	..	..	..	..
Danthonia	..	..	..	..	..	..	2	2	8	..
Agrostis spp.	..	..	..	..	..	4	2	..	2	3
Chewings fescue ..	..	..	..	..	..	3	3	8	..	3
Paspalum	..	..	..	..	..	..	..	..	..	2
Red clover	2	..	2	2	2	..	..	..	..	1
White clover	1	1	1	1	1	1	1	1	1	1
Alsike	..	2	..	..	..	..	..	..	..	..

In North Auckland paspalum almost takes the place of cocksfoot on many established bush-burn pastures and permanent ploughed grass-lands. In most cases the paspalum was not the dominant ingredient in the mixture, but it has competed successfully against all the other sown and alien elements. The succession, in other words, is from cocksfoot-ryegrass to paspalum. It would appear probable that over much of the Auckland land districts paspalum is destined to become the dominant vegetation element of unploughable grass-land, provided the present system of generally including it in mixtures for such land is maintained. There is much controversy on the wisdom of the general sowing of paspalum.

GRASS FROM SHRUB-LAND AND FERN-HEATH.

Shrub-land and fern-heath consists in the main of fern and manuka. Much the same mixtures as are used on certain types of forest country are used in the breaking-in of shrub-land to grass. But there is an essential difference in surface-sown areas of shrub-land and heath in that the struggle between the fern and manuka and the grass is right from the sowing onwards. In forest country the original forest does not regenerate when thoroughly cut and burnt, but shrub-land and fern-heath does. In these circumstances very special systems of management have to be carried out, and, in general, mixtures contain a larger proportion of what are termed inferior grasses than do true bush-burn seedings.

On ploughable land shrub-land and fern-heath is not usually surface-sown, and certain types of crop-rotation may be carried out before any final seeding is attempted. Fern-heath and shrub often arise as succession growth on bush-burns, but this point will be touched on later. For a fairly full account of the conversion of fern-land into grass my article in the June, 1916, *Journal* should be consulted.

SWAMP GRASS-LAND.

Swamp areas are only surface-sown when ploughing is an impossibility. On good swamp, fairly well drained, and sufficiently cleanly burnt to secure a good seed-bed, mixtures similar to those used on kahikatea bush-burns are used. On poor swamp-land a Yorkshire fog *Lotus major* mixture is that generally used; while on peat-swamps (when a system such as adopted at Ruakura cannot be carried out)* Yorkshire fog alone is often sown. Such land generally has to be burnt over from time to time, and resown with fog until such time as conditions are suitable for the preparation of a seed-bed adapted for the germination of a higher-class type of vegetation.

In various parts of New Zealand there are numerous kinds of swamp associations. The majority of these, however, have not been sown with the plants that are now dominant. Again, many of the associations change from time to time according to variation in the wetness, solidity, and capacity of stocking that occur.

The following are some of the more important of these swamp associations, in each case the dominant plants giving the name to the association and the grass-land: (1) *Glyceria fluitans*, (2) *Poa aquatica*, (3) *Festuca arundinacea*, (4) *Alopecurus geniculatus*.

In many swamp associations certain semi-aquatic plants may be extermely abundant, such as phormium, niggerhead, and *Mariscus ustulatus*. Drained phormium-swamps are often characterized by the abundant growth of Yorkshire fog, *Poa annua*, *Poa trivialis*, *Alopecurus pratensis*, and tall fescue. The grass-development in flax-swamps is often large, and they may be regularly stocked with bullocks. If, however, this is done without due regard to the requirements of the flax it often ends disastrously for the latter.

Tall fescue, at one time considered to be of immense value in the formation of swamp pastures, has caused the temporary ruin of more really high-class dairying-land than probably any other of our introduced plants. Good methods of converting tall fescue into first-class

* See article, "Development of Swamp-land at Ruakura," by A. W. Green, in January, 1918, *Journal*.

grazing-land have, however, been well worked out and applied by many farmers; but in all cases drainage sufficient to enable ploughing to be carried out is necessary. The work of Mr. Noel Wilson, in the lower Rangitikei, is a notable example of tall-fescue control under rather unfavourable drainage conditions.

(To be continued.)

TREES AND THE SAND-DRIFT PROBLEM.

PINUS INSIGNIS ON SEAWARD SIDE OF RAILWAY NEAR FOXTON, MANAWATU.

Planted on sand-drift about thirty-five years ago. See last month's *Journal*, page 352.

SEED-TESTING NOTES.

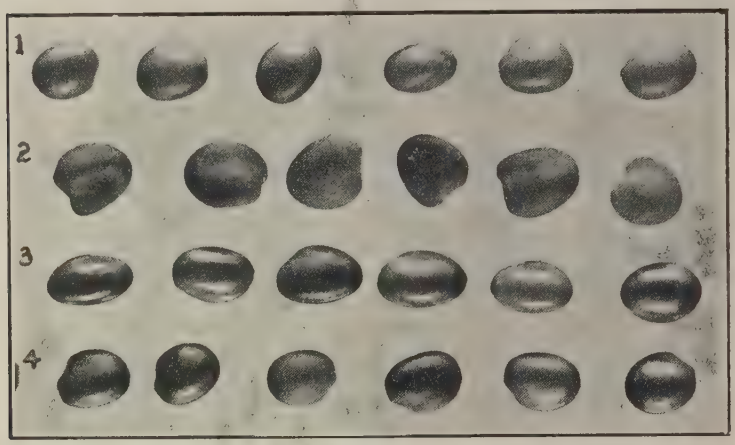
By E. BRUCE LEVY, Biological Laboratory, Weraroa.

HARESFOOT-TREFOIL AS AN IMPURITY.

THE following is an analysis of a white-clover-seed sample received recently for testing :—

	Per Cent.
White clover	75
Suckling-clover	7½
Haresfoot-trefoil	12
Other extraneous seeds	5½

This is the first time that haresfoot-trefoil has been recorded in this laboratory as an impurity in anything like the amount shown.



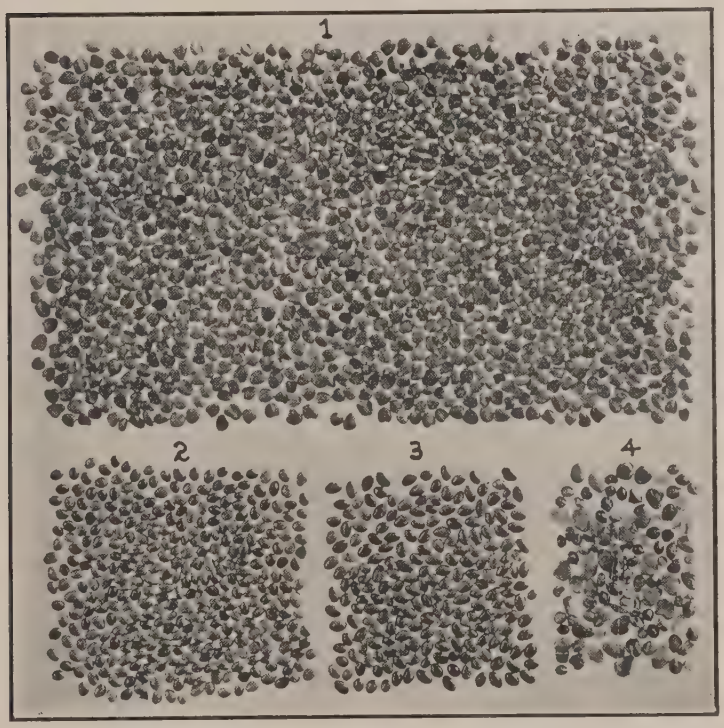
SHOWING RELATIVE SIZE AND SHAPE OF HARESFOOT-TREFOIL (1 AND 4), WHITE CLOVER (2), AND SUCKLING CLOVER (3).

Magnification 10 diameters. [*E. Bruce Levy, photo.*

It would appear, however, that the sample represented a genuine seed crop, the line being New-Zealand-grown and harvested in the Marlborough District.

Haresfoot-trefoil (*Trifolium arvense*) is an annual, and in the North Island is confined mainly to coastal areas and gravelly river-terraces. It is common also in the lighter land of Canterbury and stony areas generally throughout the South Island. As a pasture-constituent it is practically useless. On worn-out pastures which have reverted to danthonia, yarrow, agrostis, catsear, &c., haresfoot-trefoil is often

abundant, noticeably so in wet seasons. In such seasons the plant does fulfil rather an important part in the pasture association in much the same way as suckling-clover in similar seasons. Suckling-clover, however, has a much wider range of adaptability to habitat, and because of this fact the presence of its seed in a line of white clover is, from a pasture point of view, not wholly undesirable, although one



SHOWING DISSECTION OF ONE GRAM OF WHITE-CLOVER SAMPLE.

(1) White clover, (2) haresfoot-trefoil, (3) suckling-clover, (4) other extraneous seeds.

Magnification 2 diameters. [*E. Bruce Levy, photo.*

may well object to paying 2s. 6d. or so a pound for the seed when it could be bought for 6d. or less. Haresfoot-trefoil, on the other hand, has no value as a commercial commodity, and unless the lines containing this seed are used for special areas no good whatsoever will result from the haresfoot-trefoil present. No harm will be done, however, and the question resolves itself into one of the purchase price of the white-clover - haresfoot-trefoil line.

Haresfoot-trefoil as an adulterant is inferior to clustered-clover (*Trifolium glomeratum*) for reasons akin to those ascribed to suckling-clover. Clustered clover, it will be remembered by those in the seed trade, was used as an adulterant in white clover some three years ago.

The following is a description of haresfoot-trefoil for technical identification purposes :—

Size : Average length, $\frac{1}{24}$ in. ; average width, $\frac{1}{32}$ in.

Shape : Squat-oval, almost spherical ; faces less convex than edges ; radical tip prominent ; groove marked by dark-green shading.

Surface : A semi-mat with slight gloss.

Colour : Light yellow tinted throughout with green.

Addendum.—Since writing the foregoing notes a further sample of farmer's dressed white-clover seed from the Marlborough District showed on analysis 24 per cent. of haresfoot-trefoil. The wet conditions experienced last season in the Marlborough district apparently had the effect of extending the growing-period of haresfoot-trefoil. More normally the seed of this trefoil is shed before white clover is harvested.

Seaweed is considered a valuable manure for most vegetables, and adds humus to the soil. It may be dug in as soon as it is gathered, if desired, and in that case it should be buried well below the surface or it will be likely to interfere with cultivation. It is best, however, to stack it for a short time ; it soon decays and is handier to use. For asparagus it is used as a top-dressing. Rubbish among seaweed will do no harm, provided pieces of wood be thrown out.

REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT AT 30th APRIL, 1918.

District.	Creameries (Butter).	Factories (Cheese).	Private Dairies.		Packing-houses (Milled Butter).	Totals
			Butter.	Cheese.		
Auckland	55	54	1	..	9	119
Taranaki	35	115	20	..	4	174
Wellington ..	22	74	1	3	15	115
Hawke's Bay ..	11	24	..	..	..	35
Nelson	7	5	..	..	9	21
Marlborough ..	4	7	..	..	..	11
Westland	7	3	..	..	..	10
Canterbury ..	11	16	1	15	1	44
Otago and Southland	10	104	..	..	3	117
Totals, 1918 ..	162	402	23	18	41	646
Totals, 1917 ..	164	392	19	22	42	639

NOTE.—Five dried-milk factories and one condensed-milk factory were also operating at 30th April.

WORK FOR THE COMING MONTH.

THE ORCHARD.

By J. A. CAMPBELL, Assistant Director of the Horticulture Division.

THERE is scarcely an orchardist throughout the Dominion who has not during the past five seasons been rudely reminded of the serious effect of fungus diseases on his fruit crop. He is, or should be, also aware that the most critical period of attack and control is during the early part of the growing season. The lack of care and vigilance during this period may seriously affect the result of the whole season's work, and as the month of August practically marks the beginning of spring in the orchard it is evident that this critical period is at hand. Such diseases as brown-rot and black-spot are yearly assuming more serious proportions. The unfavourable climatic conditions which have prevailed for several seasons past have not only resulted in a rapid development and a serious loss of fruit, but many orchards are permeated with disease-spores, which are to be found on dead leaves, decayed fruit, and infesting the trees generally, awaiting only suitable warmth and moisture to change their character and recommence their depredations on fruit and foliage of the new season.

Another important factor to be considered in the control of orchard diseases is the present extremely high cost of spraying-materials. There is a great danger that this will in some instances at least adversely affect the season's spraying programme, and a word of warning on this score may be permissible. Economy is no doubt a praiseworthy virtue, but "you cannot have your cake and eat it also"; in other words, you cannot make fruitgrowing pay and economize in spraying beyond a certain point, and that point is governed by the conditions prevailing. The control of orchard diseases, particularly fungus diseases, lies in prevention rather than cure; the work must be done in advance, and should be sufficiently thorough and embracing to meet the worst conditions that are likely to prevail. This is the only spraying economy the fruitgrower can afford. The aim of the fruitgrower is to raise good clean crops of fruit. With this object in view, although he cannot unduly economize in spraying, he can assist the result of this work by taking other precautionary measures. Such measures will be referred to later on.

THE NEW SEASON'S SPRAYING.—CULTIVATION.

Although the buds begin to swell and some of the early-blooming varieties of stone-fruits will flower during the month a commencement only will be made with the new season's spraying, the major portion of this work will come on later. Assuming that the orchard has been pruned and thoroughly cleaned up, oil sprays may be applied for the control of red mite, mussel scale, San Jose scale, woolly aphis, mealy

bug, &c. There is a general tendency to increase the strength of winter oil sprays, one reason being the suspicion that the oil used in the majority of the oil preparations is not as heavy as formerly, and the second and most important that better results can be obtained from the stronger mixture.

The strength at which a spray should be used is governed by that required to effectually control the hardiest insect or disease present. In connection with the winter control of insects, this is to be found, in the majority of our orchards, in the eggs of red mite or mussel scale. Consequently these insects largely fix the spray-strength required. In the North Island, for pip-fruits nothing weaker than oil 1–10 to 1–12 has proved to be entirely satisfactory, while a mixture somewhat stronger has been found necessary in the South Island.

After having applied the oil sprays, let us consider in what way the control of fungus diseases can be assisted at this stage and the class of sprays to recommend for future use. As before stated, most fungus diseases are carried over on such material as old leaves, fruit, and on the tree itself. This is the resting stage of the disease, and it is not until the spores take on their summer or conidial form that affection takes place. The object, therefore, should be to remove as far as possible all spore-bearing material. This can largely be done by turning under all the old surface soil and leaves with plough and spade before the change mentioned takes place, which occurs when the weather of the spring becomes sufficiently warm, or about the time the buds are bursting.

For the present, in view of the ravages of brown-rot, cross-ploughing in the spring is unadvisable. An orchard that was ploughed in the autumn, if the growth is not too heavy, should be worked down with the disks and harrows, or whatever implements best suit the circumstances.

The winter spores resist strong fungicides, whilst the summer form is readily destroyed by the ordinary mixture used. This means that there is little to be gained by spraying prior to the commencement of the change from the winter to the summer form, and as this continues over a considerable period a lasting fungicide, such as bordeaux, is preferable to a quick-acting one, such as copper-sulphate solution. Even then it is necessary to renew the application at frequent intervals during this period in order to keep the new growths that are made in the meantime as well protected as possible.

As regards peach and nectarine trees, it would be advisable to substitute lime-sulphur, 1–125, or self-boiled lime-sulphur, 8-8-50, for bordeaux after the first application of the latter mixture.

Summarized, the spraying advice here given is as follows :—

Pip-fruits : For red mite, mussel scale, San Jose scale, woolly aphis, mealy bug, &c.—oil emulsion, North Island, 1–10 to 1–12 ; South Island, 1–8 to 1–10. If red mite and mussel scale are not present use oil, 1–15.

Stone-fruits : For red mite, San Jose scale, &c.—oil emulsion, North Island, 1–15 to 1–20 ; South Island, 1–12 to 1–15.

Stone-fruits : For brown-rot, leaf-curl, rust, &c.—bordeaux, 8-6-40, when buds show pink ; lime-sulphur, 1–125, or self-boiled lime-sulphur, 8-8-50, when three parts of the blossoms have fallen, again when the fruit has set, and again about four weeks later.

PREPARATION OF SELF-BOILED LIME-SULPHUR.

American experiments show that both commercial lime-sulphur and self-boiled lime-sulphur are successful in summer remedies against brown-rot. The latter is more popular than the former, as it is less injurious to the foliage. The method of preparing self-boiled lime-sulphur is as follows :—

The standard self-boiled lime-sulphur mixture is composed of 8 lb. fresh stone lime and 8 lb. sulphur to 50 gallons water. Any finely powdered sulphur (flowers, flour, or "commercial ground" sulphur) may be used in the preparation of the mixture. In order to secure the best action from the lime the mixture should be prepared in rather large quantities, at least enough for 200 gallons of spray, using 32 lb. lime and 32 lb. sulphur. The lime should be placed in a barrel, and enough water (about 6 gallons) poured on to almost cover it. As soon as the lime begins to slack the sulphur should be added, after first running it through a sieve to break up the lumps, if any are present. The mixture should be constantly stirred, and more water (3 or 4 gallons) added as needed to form at first a thick paste and then gradually a thin paste. The lime will supply enough heat to boil the mixture several minutes. As soon as it is well slaked water should be added to cool the mixture and prevent further cooking. It is then ready to be strained into the spray-tank, diluted, and applied. The stage at which cold water should be poured on to stop the cooking varies with different limes. Some limes are so sluggish in slaking that it is difficult to obtain enough heat from them to cook the mixture at all, while other limes become intensely hot on slaking, and care must be taken not to allow the boiling to proceed too far. If the mixture is allowed to remain hot for fifteen or twenty minutes after the slaking is completed the sulphur gradually goes into solution, combining with the lime to form sulphides, which are injurious to peach-foliage. It is therefore very important, especially with hot lime, to cool the mixture quickly by adding a few buckets of water as soon as the lumps of lime have slaked down. The intense heat, violent boiling, and constant stirring result in a uniform mixture of finely divided sulphur and lime with only a very small percentage of the sulphur in solution. It should be strained to take out the coarse particles of lime, but the sulphur should be carefully worked through the strainer.

CALCULATING THE AGE OF ORCHARD-TREES.

As there appears to be some confusion in the method of calculating the age of a fruit-tree I may here record the plan followed by the Department. The age of fruit-trees when planted, whether they are one or two years old, is not taken into account at any time when calculating the age of an orchard. When planted an orchard is practically of no age, or is in its first year, and does not become one year old until the growth begins in the spring of the year subsequent to planting. Thus an orchard planted in the winter of 1910 becomes one year old in the spring of 1911, and seven years old in the spring of 1918. Any fruit taken from such trees during the season of 1918–19 is taken from seven-year-old trees, and not from eight-year-old trees, as is commonly considered to be the case. Such trees are in their eighth year, but are not eight years old until the spring of 1919.

POULTRY-KEEPING.

By F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF BREEDING-STOCK.

On the majority of plants, and especially where heavy breeds are kept, August should see the hatching and brooding operations in full swing. The first step to success in this important work is to see that the breeding-stock are managed to the best advantage. They should be fed well on a plain diet, but on no account should high records in egg-yield be looked for, or trouble will be met with in the hatching and rearing of the chicks. This is not to say that breeding-birds should be kept on a light ration, but rather that meat and other such forcing-foods should be sparingly supplied.

If the birds are inclined to become too fat they should be encouraged to exercise by feeding the grain ration in deep litter. This is important, for a high percentage of fertile eggs containing strong germs cannot be expected from a hen that is overfat. Profitable stock can only be produced where the parents are maintained in a healthy active condition. It is not generally known that breeding from overfat hens is a common cause of chickens dying from undigested yolk when from three to four weeks old. Instead of the yolk becoming absorbed it forms into a hard substance, and consequently death soon follows. Once chickens become affected in this way nothing can be done for them. Of course there are other causes of this trouble, such as keeping the incubator at too high a temperature, or feeding the chicks too soon after hatching. The trouble will, however, be greatly minimized by correct management of the breeding-pen. It will usually be found that the most fertile eggs and the strongest chicks are produced from parents that have a free range, or at any rate large-sized runs. No doubt this is chiefly due to the natural exercise taken by the birds, which prevents them from putting on surplus fat.

Some breeders obtain excellent fertility in the eggs and most gratifying stock as a result of feeding whole grain to the breeders night and morning, the grain being fed in a litter in order to induce the maximum amount of exercise. Where this method of feeding is adopted an ample supply of sharp gravel grit is imperative, as it greatly assists the birds to assimilate the hard grains. A good plan is to give the breeding-stock a variation of feed in order that the hen may put into the egg the necessary elements for the production of healthy chicks and robust stock. Another necessary means of maintaining the breeding-birds in good condition is to keep them well supplied with green material.

The quarters should be kept in a sanitary state and absolutely free from vermin. Especially does this apply to red mite, for a hen cannot produce good strong chicks if its life-blood is being nightly drawn away by insect pests. No care is too great for breeding-birds.

It is safe to say that hundreds of pounds' worth of eggs are wasted annually merely for the want of observation. If a high percentage of infertile eggs is found when testing them the cause should be looked for. Probably the male bird may be run down and out of condition, or perhaps the hens are too fat and have insufficient exercise. It is a

good plan to frequently handle the male bird at night; he may be too attentive to the hens and not take sufficient food, in which case it is impossible to get good results. If a male gets out of condition he should be fed at least once a day by himself. Selecting the right class of stock for the breeding-pen is of great importance, but the management of breeding-birds is of equal importance, for upon their maintenance in the right condition largely depends the success of hatching and rearing of the chicks.

THE SITTING-HEN.

Notwithstanding the fact that no artificial means of hatching and rearing chicks has so far been discovered to improve on the natural mother, it is safe to say that a very high percentage of good hatchable eggs are spoilt and chickens lost annually where this method of rearing chicks is being employed. The failure to rear the desired number of birds is usually put down to bad luck, but it is more often a matter of bad management, chiefly because the hen is not given an opportunity to properly carry out her work. When the hen steals her nest away she usually brings out a big hatch. Therefore to be successful when using hens for this purpose the aim should be to make the conditions as natural as possible, and at the same time have the hen and her brood under proper control.

In the first place the nest should be made on the ground, and formed into a saucer shape, so that the eggs will not roll out. On the other hand, it must be made in such a way that the eggs will not roll on top of each other. The bottom should be flat in order to allow the hen the necessary room to turn the eggs, which she does several times a day. Dry fine grass makes good nesting-material. The nest should be made in an isolated place, preferably in a coop with a run attached, when the hen will be undisturbed and allowed to hatch and rear her brood to a safe age. A coop 30 in. square, and a run about 8 ft. long, 3 ft. 6 in. wide, and 18 in. high, will serve the purpose. The coop should be so made that it can be easily moved on to fresh ground. The roof, sides, and back walls must be wind-and-rain proof. It should also be rat-proof, while the run should also protect the chicks from their natural enemies. When possible the coop should be placed on a dry well-sheltered situation, where the ground is fresh and covered with short grass. It should be so arranged that the chicks will have the maximum of sunshine and at the same time be protected from cold wind. It is always best to have a boarded floor to a coop, unless, of course, the coop is under cover. When a wooden floor is not used the inside of the coop should be raised with dry earth about 3 in. above ground-level. This will help to keep the hen and her brood high and dry when wet weather conditions prevail. It is always a mistake to give a hen with a young brood a free range, as there is always the risk of the chicks being taken by cats.

Many hens are compelled to leave their eggs just when they are on the point of hatching, because they are pestered beyond endurance with vermin. The best way of dealing with these pests is to dust the hen with an insect-powder previous to being set, and again prior to hatching. Never dust a hen when the chicks are very young, as the powder is apt to get into their eyes and cause blindness.

It is also a mistake to put a hen on valuable eggs at her first sign of broodiness. The best plan is to try her first on some dummy eggs. It is inadvisable to put too many eggs under a hen; as a general rule twelve to fourteen is a sufficient number to obtain best results. After five days of incubation the eggs should be examined by means of a tester, and any which are infertile or containing dead germs should be removed. A good plan is to set several hens the same day, and should a number of the eggs be subsequently found to be infertile fewer hens will be able to take the fertile eggs. Do not interfere with the hen when hatching; she can manage best by herself. The only food sitting-hens require is whole grain, grit, and clean water.

THE APIARY.

By E. A. EARP, Apiary Instructor.

PREPARATIONS FOR THE NEW SEASON.

DURING the dormant season every spare moment should be spent in making preparations for next season's work. All defective supers, roofs, and bottom-boards should be overhauled, and where necessary given a good coat of paint. This work, if delayed, is apt to interfere with the main work in the apiary when the bees are calling for special attention, and should not be postponed. If it is desired to increase the apiary, push on with hive and frame making, and make ample provision for increase before the actual time arrives for putting preconceived plans into operation. Where the beekeeper does not make his own hives he should now order in sufficient stocks to see him through the season. In the majority of cases it does not pay the beekeeper to make his appliances. Hive-manufacturing in the Dominion has been brought to a high standard, and unless the apiarist has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on those lines. Non-fitting supers and frames mean extra labour and lead to endless trouble in the long-run. In the past manufacturers have been greatly to blame for continually altering the type of hive placed on the market, and consequently beekeepers have found great difficulty in keeping appliances uniform. As yet no regular type of hive has been adopted for the Dominion, but the dovetailed hive now so popular among beekeepers is easily the best offered by the suppliers. The sizes in use are mostly ten and twelve frame, and experience of his district will enable the beekeeper to decide as to the best one to adopt. To meet those cases where cost is a consideration a durable frame-hive can be made out of a petrol-case, which will comply with the provisions of the Apiaries Act. Petrol-cases are obtainable for a few pence, and can be readily converted by any one handy with tools. A kerosene-

case may also be used, but it will be found necessary to reinforce it, so that the petrol-case is the handier. For particulars of a cheap home-made hive see Bulletin No. 55, "Bee-culture."

Overhauling the Hives.—As advised last month, all supers should be removed and the bees confined to the brood-chamber. This will keep the bees snug and promote brood-rearing, and at the same time facilitate the work of giving the hives their first spring overhaul. During the course of the winter there is usually an accumulation of pollen, dead bees, &c., on the bottom-boards, and consequently they require cleansing. All operations at this period should be carried out quickly as a safeguard against robbing. To cleanse the bottom-board bring into use a spare one. Set the hive temporarily on the spare board while scraping and cleansing the permanent one, then replace the hive on its permanent stand. See that the hives have a slight cant towards the entrance. This will prevent moisture settling on the bottom-board, which is apt to cause the death of a considerable number of bees, besides making the hive damp and unwholesome.

Containers for Export.—A mistake often made by beekeepers who prepare bulk honey for export is to leave the preparation of their containers until the honey is extracted. Supplies of tins should be obtained in the off season, when more time and care can be spent in seeing that they are fit to contain the season's crop. All these, whether intended for export or the local market, should be carefully cleansed and dried prior to giving them a coat of oil or lacquer. From experience gained at the grading-stores it is apparent that beekeepers do not pay sufficient attention to packing. The tin is looked upon as a mere container and is treated as such. Consequently points are lost for packing, when a good coating of boiled linseed-oil to prevent rust-spots, if applied when the tins are first obtained, would have altered the points allotted. Efficient methods of packing for export are required, and not the slipshod packing adopted in the past for auction-room sales.

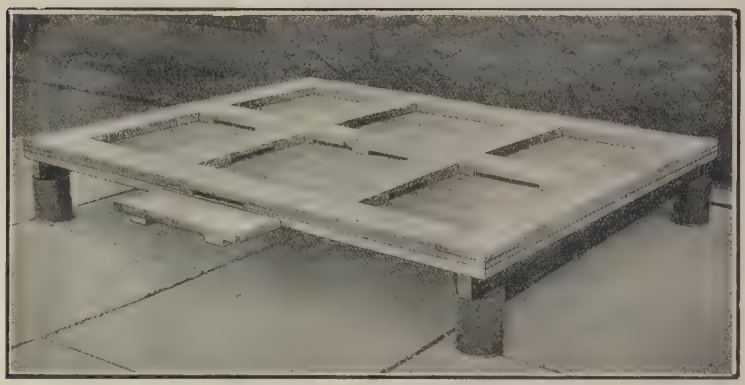
SPRING WORK.

During August, whenever the temperature will allow, the colonies may be given their first examination. It is highly important that this work should not be postponed until brood-rearing has started in earnest, more especially in cases where ample stores were not left to carry the bees over the early stages of this important function. Delay in making an examination may lead to spring losses, and nothing is more tantalizing than to find colonies dead through neglect to provide sufficient stores. Usually a colony's requirements are attended to in the late autumn, when the apiarist endeavours to gauge the amount of food requisite to carry the bees through the winter and spring periods. It may happen, however, that mild weather will be experienced, when the drain on the stores to feed the young bees, if not supplemented, will reduce a colony to starvation. Nothing should be left to chance during the critical months of spring, and no effort spared to see that each individual colony has sufficient food to meet current demands. Colonies which contain 15 lb. to 20 lb. of honey may be left until a later examination. If the hives contain less they should be watched closely and preparation made for feeding. See Bulletin No. 55, page 37, regarding the spring-feeding of bees.

Queen-right Colonies.—Next to the item of stores the most important factor in a colony's condition is its queen. Advantage should be taken of the first examination to see that the queen is all right. If a colony is in normal condition as regards strength and stores there should be fair-sized patches of brood in the centre frames, but this is not sufficient to determine that the colony is queen-right. The cells adjacent to the brood should be hurriedly examined for eggs, which are the only indication that the queen is present. If neither brood nor eggs are found, then shelve the question of the colony being queenless for about ten days later. At each examination make a note of each hive and its condition for future reference.

THE "DEADMAN" SUPER-CLEANER.

In response to several inquiries for particulars of making a "Deadman" super-cleaner (which system was described by Mr.



THE "DEADMAN" SUPER-CLEANER DEVICE.

Trythall in the last April *Journal*) the accompanying photo has been taken of the contrivance and will afford a good idea of how to proceed. The foundation of the super-cleaner is made in the form of a frame 4 ft. 5 in. long and 3 ft. 6½ in. wide, and is divided into six compartments. The two central ones are 14¾ in. wide, extending from the back to front, and 14¼ in. from side to side, and the four corner compartments each 14¾ in. by 10¾ in. The timber used in the construction of the frame and divisions is 4½ in. by 1 in. The entrance to the central hive carrying the colony of bees is made through the frame, and is 6 in. long and ½ in. deep, and the openings to the compartments intended to carry the supers of combs are the same width as the entrance to the hive. The openings afford the bees entrance to every super on the board. The floor carrying the frame is made of tongued-and-grooved boards, and it is essential that it be bee-proof except for the entrance. Two supports extending the width of the construction

are intended to strengthen and at the same time carry the floor-supports. In order to prevent the timber from rotting it is advisable that the super-cleaner be raised at least 6 in. from the ground. An alighting-board, 16 in. long by 6 in. wide, should be attached to the entrance to facilitate the bees entering the cleaner.

VITICULTURE.

By S. F. ANDERSON, Vine and Wine Instructor.

THE COOL VINEHOUSE.

AFTER pruning and cleaning the vine-rods the vinehouse itself should be cleansed. The condition of the vine borders should then be attended to. No cultivation or manurial treatment will avail the health of the vines if the roots are in a cold undrained soil—a condition too often met with in vinehouses attached to town gardens. A good get-away for the water is the first consideration.

It is assumed that the outside borders when made were trenched at least 2 ft. deep and of a liberal width. When the vines have reached their full bearing stage—say, five or six years from their first bearing fruit—the outside borders should be as wide as the rafters are long. They need not be so wide when first started. Adding to them a little each year up to that width, provided the soil is good, gives the roots new stimulus. Supposing the borders have reached the limit to be allowed them, then the supply of plant-food has to be added each season. It should be understood by the vine-grower that the best restorer is not entirely strong artificial or animal manures. Good compost of well-rotted weeds, old spent lime or mortar rubbish, road-sweepings, as well as top-dressing with any good soil, is very beneficial, together with a moderate supply of artificial manure. If it is bonedust, then about 2 oz. to the square yard would be a fair addition. Another very necessary condition to the growth of the vine is that the air can enter the soil. It can only do this where the composition of the soil, good drainage, and frequent cultivation permits.

It is better not to grow anything on the borders. The vines require the feeding-ground, and give big returns for the space allotted them. If the ground is required, a row of lettuce or some such small stuff is the most that should be attempted in this way.

THE VINEYARD.

As the prunings are being cleared and the vines tied to the wires the bordeaux should be applied. If left till after the ploughing, the rough state of the ground makes the work much heavier. It was mentioned in last month's notes that this spraying is one of the essentials. The ploughing of the vineyard has to be done with a single-furrow plough on account of the espalier fences, and it is necessary to have headlands of ample width for turning out of one row

into another with two horses. The vineyard should be divided off by the ploughman into lands of so-many rows each. Eight is a convenient number. Strike down No. 1 and up No. 5, down No. 2 and up No. 6, down No. 3 and up No. 7, down No. 4 and up No. 8. This allows of easy turning into the rows, and completes the first round. Then reverse the order, commencing at No. 8 and finishing at No. 1. This throws the two furrows (which should be 6 in. deep) up against one another. Care must be taken that no core is left between the two; it does not make a pretty job, but breaks up the centre completely. The next two furrows on either side of the ridge made should be 5 in. deep, the next two 4 in., and the finishing ones 2 in. to 3 in. Throwing the soil into the centre a little does not matter, and it helps to aerate the whole better; when the cultivator gets to work in the spring it is soon levelled down. Graduating the depth of the ploughing from the vines to the centre of the row drains the water to that place to soak away, hence a drier condition of the vines and less chance of mildew in the summer. It is advisable to leave the land in the rough furrows as long as possible before levelling down with the cultivator, so as to aerate and get a frost or two on it.

CELLAR WORK.

Subject to getting clear cold weather, August is the best month to proceed with the main racking of the new wine and any other that requires it. This work is best performed before the equinoctial period. The same remarks apply to bottling and fining of the wine. Too much emphasis cannot be put on the importance of conducting all moving of the wine from one vessel to another with as little contact with the air as possible. Exposure of wine to the air causes it to part with alcohol as well as bouquet and flavour. The alcohol in the wine being low is speedily oxydized by the air, hence a change takes place, and acetic acid may be formed. The lighter and more delicate the wine the greater is the effect of exposure on it. The ordinary wine-pump, hose, and siphon supply the best means of transferring wine. Wine should not be allowed to run into tubs and be baled out into other vessels unless for a special aerating purpose.

THE GARDEN.

By W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

AUGUST may be regarded as the last month in which to plant the summer varieties of rhubarb, as the crowns will then be breaking into growth. It is also the best month in many places for planting, because growth immediately follows, and the soil can be kept in good condition to the last moment. The new roots quickly take possession of the soil, which is becoming warmer, and a good start should be assured.

Rhubarb frequently fails to give satisfaction because it is not properly treated. No stalks should be taken the first season. All the plant-energy should be spent in establishing the roots and building up good crowns for the next season. If this plan is followed, other conditions being right, a good crop should be got the second year. The future value of the plantation will largely depend on the extent to which the crop of stalks is taken, and here is where most mistakes occur. The crop for the next season depends on the kind of crowns that are developed the preceding autumn, and this can be done only by leaving the stalks unpulled for a certain period. New stalks grow until late in autumn. In some places where the summer is very dry the autumn crop may be better than the midsummer crop, and this tempts inexperienced growers to take it for use. The effect is that the plants start the next season with weak crowns, the spring crop is very poor, and a considerable amount of growth is necessary to strengthen them before good stalks are made. Rhubarb is of greatest value during the period prior to the coming-in of summer fruits; therefore the treatment accorded it should be to secure its best during that period, the early crop being of highest value. To obtain this result no produce should be taken after January at the latest. The most successful growers of rhubarb—those who make most money by it—cease pulling at the end of December.

The winter varieties occupy a different position. They are available for use during most of the year, but should not be pulled much during summer. They should be left to strengthen the crowns, so that the plants become furnished with strong crowns by autumn and give good stalks through autumn, winter, and early spring. Roots may be planted now or seed sown in October. Whichever course is adopted the future procedure should be to obtain a good strain by selection, saving seed from the best types, which differ greatly, and raising plants from the seed. The best results are obtained by sowing seed where the plants are to grow, thinning to the required distances, about 2 ft. each way, and never transplanting.

Reverting to the summer varieties, it is useless to expect to get a good plantation at once from seed. The plants are hybrids, and plants raised from seed vary enormously. There may be only a few really good plants in a large bed, and these would have to be selected and propagated before a profitable plantation could be established. The surest way is to begin with crowns of a good strain and propagate from them. The variety most favoured by market-growers is Myatt's Linnæus, or variations of it. Horton's Champion is one such, and is a very fine variety.

Asparagus: It is now time to put beds in order. If planted in the old way in narrow beds these should have had a covering of manure some time back, the loose top soil having been raked off into the alleyway. The soil may now be returned, and in a week or two will have settled down. A dressing of nitrate of soda, 2 oz. per square yard, may be given. Nitrate of soda is a powerful fertilizer, and given in the quantity mentioned will also kill slugs and other pests. Salt is also of use for killing weeds if they are troublesome; 4 oz. per square yard would be needed. Salt is not now considered of great value in asparagus-culture, and it is not regarded as a fertilizer. If the beds

are on the flat, as now advised, rake off loose straw that may be left from the dressing of manure, turn over the surface soil with a fork, digging as shallow as possible, and treat with nitrate of soda as mentioned, also with salt if desired.

Seakale: Forcing will now be about finished. Clear away the manure, and dig the soil over, and protect the stools from slugs or snails with dressings of lime applied at night or early in the morning. New plants can be raised by sowing seeds or by whips of the roots. The whips are secured by digging up old plants and taking roots a bit thicker than a lead-pencil. Cut the roots into lengths of about 6 in. and plant them so that the tops are just level with the surface. They are best planted in nursery rows, the whips about 6 in. apart, and the rows spaced sufficiently to allow of hoeing.

Jerusalem artichokes should be planted in August. Select medium-sized tubers of good form, and plant in drills 5 in. deep, sets 15 in. apart, and rows not less than 3 ft. apart. To economize space plant single rows in various places, placing them in positions where they will shelter more tender crops, such as French beans. Good rows form good break-winds. Good, free, loamy soil is best for artichokes; if grown on heavy soil the tubers are badly shaped. Wood-ashes are a good fertilizer.

Red-beet: Sow a moderate breadth of a turnip-rooted variety for use during summer. They come into use quicker than the long-rooted sorts, which are best for winter use, but should not be sown yet, as they would grow too large and coarse.

Parsnips: Sow a turnip-rooted variety if wanted early. Remarks about red-beet apply with equal force to parsnips.

Celery: Sow Henderson's White Plume in boxes under glass; or the boxes may be placed in a warm position and be covered with a sheet of glass.

Carrots: Sow a small lot of Early Horn type, and hold over the main sowing till later.

Turnips: August is the month to begin sowing. They come to use in seven or eight weeks from sowing, and a bed is fit to pull from during about the same period. Sow, therefore, only small lots, and make a fresh sowing about every seventh week. Extra Early Milan is the quickest, but Snowball is not much longer coming in and is a better root.

Lettuce: Plants should be put out and seed sown. The best plan to follow from now on till autumn is to plant small lots and sow a little fresh seed when plants are set out, except that during the dry months it is best not to transplant at all, but to sow in lines and thin out; then the time to sow will be when the last lot have got a good start after being thinned out. The cabbage sorts are best. Iceberg, Burpee's Brittle Ice, and Webb's Wonderful are good varieties.

Radish: Sow small lots about every ten days. The turnip-rooted sorts are best for early use, and long varieties during summer.

Onions: Seed should now be sown, if not already in, this having been dealt with in last month's notes. Planting from autumn sowing should not be delayed. The young onions must be planted as shallow as possible, only the roots being buried. It will do no harm to ridge the soil up a

little to hold them in position, provided the ridges are levelled down when the plants are able to stand.

Spinach: A sowing of the round-seeded variety may be made; it is the quickest growing of all green vegetables. Small sowings should be made about every fourth week throughout the spring and summer months. It is usual to sow between rows of other vegetables, such as cauliflowers. If the seed is put in soon after such crops are planted, the spinach is used and gone before the other crops require the space. By adopting this plan the spinach is obtained with no trouble except sowing the seed.

Cabbages and cauliflowers: These should now be planted, unless already put out in accordance with advice previously given.

POTATOES.

In frost-free places early planting will be already done. In most places in the North Island planting of limited areas is carried out towards the end of August, and main crops in September. In the South Island most planting is done in October. Late planting—in relation to the district—is usually wrong, because dry weather is likely to occur before the plants have made substantial growth, and the result is a low yield. Seed tubers should be procured at once; late buyers have sometimes to put up with indifferent sets procured when stocks are depleted.

A further and more important reason for securing seed-potatoes in good time is that the period is approaching when the tubers begin to sprout. When the tubers are in bulk sprouting is accelerated. The sprouts come white through darkness and are easily knocked off; they are usually rubbed off, in fact, so as to encourage further sprouting; they would mostly be lost in planting if left. The first sprouts are the strongest and best, and later sprouts do not give such good crops. Therefore the tubers should be spread in thin layers and be exposed to light and air, so that the first sprouts may come short, strong, and green in colour. They can be kept in that condition till planting-time. The best way to sprout the tubers is in shallow boxes, as described previously on several occasions, and this condition should be approximated as nearly as possible. The tubers should not be cut until the day they are planted; if cut before, they lose moisture and shrivel and do not yield so good a crop.

If a moderate amount of stable manure has been dug in no other manure may be wanted, but a little superphosphate is never wasted. In gardens the best way to plant is in drills drawn with a heart-shaped hoe, which ensures the sets being covered to an even depth. Superphosphate may be strewn along the drill, allowing 1 oz. per lineal yard. A handful of wood-ashes thrown over each set will also have good effect.

SMALL FRUITS.

Strawberries.—August is the latest month in which to plant strawberries, and for many places I consider it the best month. This refers to situations where the soil becomes wet and cold during winter, and where the plants if set out in autumn would at best only exist through the winter months, and would probably come through with the loss of many roots. But when intending to delay planting till August,

as I myself have many times done, I always provide for it by bedding out my plants in March or April in a good plot of ground, allowing just enough space between the plants to keep them clear of each other. They are then fine strong plants by spring, and are lifted with a fork and each planted with a good ball of roots and soil. This method may not be feasible for large cultivations, but it is just the thing for private gardens, and may be slightly modified for large plantings by bedding a little closer in autumn and lifting less soil when finally planting. In any case planting may be done quite safely during the first half of August, provided that expedition is used and the plants not allowed to lie about longer than can be helped. The less time there is between lifting and planting the better chance the plants will have.

Gooseberries, Currants, &c., begin to grow during August in most places, and any planting intended should be done at once. Stable manure is considered by authorities to be indispensable to bush-fruits, and to obtain best results they advise the application of a fertilizer in spring just as growth begins. The fertilizer recommended is nitrate of soda, 2 parts; superphosphate of lime, 1 part; iron sulphate, 1 part —1 lb. of the mixture to every 3 square yards.

Cape Gooseberries.—Last year's plants may now be cut down to within a few inches of the ground. Numerous young shoots that are probably springing up from the base of the plants will furnish the new bush. In places where sharp frosts occur it will be best to delay cutting till they are mostly past, as the tops protect the shoots. New plantations can be set out as soon as it is safe. Frost-occurrence should rule the time for planting. I prefer to plant in clumps of three plants, each set about 9 in. from the other in a triangle. As the branches grow they lock together and prevent injury by wind. Five feet apart is a suitable distance for the clumps.

Export of Peas.—An Order in Council, dated 24th June, 1918, prohibits the exportation of peas from New Zealand save with the consent of the Minister of Customs.

Export of Mutton and Lamb.—The statement of exportation of mutton and lamb, issued in connection with the interim sheep returns, gives the following shipments for the year ended 30th April, 1918: Mutton, 2,038,304 carcases; lamb, 1,945,305 carcases. The figures for the preceding twelve months were—mutton, 2,613,259; lamb, 2,883,350, the latter amount (lamb) being itself considerably below normal.

Wheat and Oats Threshings.—According to a statement issued by the Government Statistician, returns of actual threshings throughout the Dominion received up to 22nd June from threshing-mill owners show that till then 5,998,559 bushels of wheat and 4,155,135 bushels of oats had been threshed out. The Dominion average yield per acre in cases where particulars of areas were furnished works out at 24·63 bushels for wheat and 32·78 bushels for oats. On these threshings, in wheat Canterbury averaged 24·49 bushels, Otago 26·41 bushels, Southland 27·56 bushels, Marlborough 18·49 bushels, and Wellington 20·03 bushels. In oats Canterbury averaged 27·76 bushels, Otago 36·14 bushels, Southland 42·68 bushels, Marlborough 29·04 bushels, Hawke's Bay 30·35 bushels, and Wellington 31·30 bushels.

ANSWERS TO CORRESPONDENTS.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LOTUS ANGUSTISSIMUS FOR HAY.

"NEW CHUM," Collingwood :—

What could I put with *Lotus angustissimus* to grow for seed and hay, to come ripe together; and when should I put in the seed? I want the seed for rough land and the hay for cattle. The ground is a little sour, and blackberry is present.

The Fields Division :—

Lotus angustissimus sown at the end of August or in early September at the rate of 10 lb. per acre should be ready to cut for seed before the end of February, and should yield at least 2¼ tons of hay as well as the seed. *Lotus angustissimus* when cut for seed yields excellent hay, being quite fine and leafy and extremely palatable. In the Auckland District threshed *Lotus angustissimus* straw is regularly baled for hay and commands as good a price as ordinary hay. We see no particular reason for mixing the lotus with any other grass or clover. If sown, say, with Italian rye-grass the lotus will not be ready to cut when the rye-grass is ready for hay, and the addition of any other clover is not likely to increase the bulk. It might be a good plan to spring sow the lotus with a thin seeding of oats to raise the clover, and the whole crop could be cut together.

NASAL CATARRH IN CATTLE.

JAMES M. WADDELL, Balcairn :—

I have a number of yearling heifers which have been affected for some months with a trouble in the nostrils. They make a snivelling sound when breathing through the nose; sometimes they can hardly get their breath through the nostrils at all and have to open the mouth. They have a discharge through the nose, sometimes mucus, sometimes blood, and the worst has a bad smell. Could you tell me of a cure, as it appears to distress the animals a good deal?

The Live-stock Division :—

Nasal catarrh is a very common trouble in cattle. When only one animal appears affected it is well to examine the nostril for some foreign body. This is best done by turning the animal's head towards the sunlight, or at night by using a strong light. When a number of animals are affected, such as in this case, the trouble would be clearly due to other causes, such as sudden change of weather, irritating substances from the ground or feed, and a variety of other causes over which the owner may not have control, so that he can only look to treatment of the animals. The treatment for catarrh must be both general and local. Keep the affected animals as dry and warm as possible, and with an ordinary nasal syringe douche the nostrils once a day. An ordinary spray syringe, as used by hairdressers and others, may be employed, care being taken when syringing one nostril to leave the other free. If a syringe cannot be procured, steaming the head is also beneficial. This is done by filling a bucket nearly full of hay or chaff and pouring in ½ oz. of eucalyptus-oil. Then half-fill the bucket with boiling water and hold close up to the nostrils, but not so close as to make it uncomfortable for the animal. For syringing purposes a weak solution of permanganate of potash is used at a temperature of blood-heat. Cease the treatment for a day or two whenever an improvement is noticed; then repeat if necessary.

PLANTING YOUNG LEMON-TREES.

W. BIGGAR, Havelock North :—

Kindly tell me the best method to adopt when planting young lemon-trees. I have planted a few on two occasions, but have only succeeded in getting one to grow. Do they require heading back, or any other system of pruning? When is the best time to plant them?

The Horticulture Division :—

Young lemon-trees should not be planted when the soil is cold. Probably September would be the best month to plant in your locality. If planted in autumn, as they can be, they would require early protection from frost. This would have to be afforded for two or three years after planting. The roots should be examined, and any that are damaged cut back above the injured part. If the plants were grown in pots the roots should be uncoiled and spread out. Plant very firmly. The tops may or may not require shortening. If the growth is strong it would be best to cut back a little, and any soft growth should be cut off.

CALVES WITH FOOT TROUBLE.

"CALF," Masterton :—

Some of our calves have this year got a kind of foot-rot, with a lot of pus around the hoof, and the animals walk like a foot-rotty sheep. We have applied Stockholm tar, but it does not seem to give much relief. There is no fescue on the place. Advice would much oblige.

The Live-stock Division :—

Give the affected animals a drench of Epsom salts—a 2 oz. dose—then take the feet and wash well with soapy water and soda. After this apply a fairly strong solution of permanganate of potash. Repeat the local dressing every three or four days. If you have many affected it might be worth while to make a small race and wooden trough and let them stand there for a few minutes. Stockholm tar is not recommended in a case like this.

MAKING CONCRETE FENCING-POSTS.

J. H., Fordell :—

Kindly give me what information you can regarding the making of concrete fencing-posts. I have plenty of shingle, sharp sand, and half-inch and inch piping for reinforcing.

The Fields Division :—

A wooden box is first made of the dimensions proposed for the post. Then lay 2 in. of concrete material on the bottom, and place wires on this the whole length of the box; again add 2 in. of material and lay wire, continuing until the box is filled. Two, three, or four wires—plain or barbed—may be used for each layer. This is a good way to use up all stray wire on a farm. Piping may be used instead of wires by placing one or two pipes on alternate layers of concrete (but thicker than 2 in.). Two pipes in centre of each post would, however, be quite sufficient.

For the holes for the fencing-wires ⅜ in. piping is used. Cut this in lengths of either 10 in. or 12 in., depending on width of posts, and place them down the centre across the posts at the distance it is proposed to have the wires. These lengths will, of course, go right through the posts. To keep them in place whilst filling the box with concrete a good idea is to take a piece of 3 in. by 1 in. batten the whole length of post, and bore holes in the batten corresponding to the distances for the wires. Fix the batten in the box, right in centre, and put the ends of the short pieces of piping in the bored holes. The concrete can be put in from either side of this batten. When the box is filled the short pipes can be pulled out, leaving a hole for the wires. If the pipes are greased they will pull out more easily.

When filling the box with concrete material the latter should be kept well watered and tamped. The proportions of the mixture generally used are 5 parts of clean fairly fine gravel to 1 part cement. After being made the posts should be allowed at least two months to thoroughly set and dry.

Posts can also be made on a line of fencing by having boxes fixed upright into the ground where it is proposed to fence. These should be treated by filling the box from the top, thus saving further handling. This method, however, will only suit for intermediate posts, not strainers. These latter must be made on the flat, as before explained. With the upright method the short lengths of piping for the wire-holes should be put right through the boxing, from which they can then be subsequently pulled out.

GROWING HAZEL-NUTS.

"HAZEL-NUTS," Morven :—

I have a few hazel-nut trees that are a little over 6 ft. high, with about equal parts of old and new wood. They have been in quite a number of years, and except for being dug round have had nothing done to them. This year I gathered a pint of nuts from under one tree. Is there any way I can make them bear? Should I cut out the old wood altogether?

The Horticulture Division :—

The management of hazel-nut trees to ensure a crop of fruit is a complicated matter, much more so than with any fruit-tree. Training begins when the young tree is planted. All suckering must be prevented, the tree should have a clean bole without suckers. Limbs are shortened annually to form the tree, which should be goblet-shaped with an open centre. Other pruning is of a complicated nature, having for its object the securing of a supply of male catkins as well as female flowers. It is sometimes necessary to gather male catkins from wild nut-trees (where such exist) and hang them in the cultivated trees. Even then an untimely frost may destroy the crop. The production of nuts by any other method than that outlined is merely a matter of chance. Young wood—if that means suckers—should be cut out and the old left, and this not too crowded. Kent is the great nut-producing county of England. Very large orchards of nut-trees are established there, and they are a very fine sight, every tree like its neighbour, all resembling well-formed gooseberry-bushes of giant form.

DEALING WITH WEEVIL IN SHED.

"MAY," Te Kuiti :—

I have a shed in which I used to store wool and sheep-skins. The weevil got at the skins, and I am anxious to keep the pest clear of the shed. Kindly advise me of the most effective method of treatment.

The Live-stock Division :—

We would recommend that everything be removed out of the store, and the latter then thoroughly washed down—roof, walls, and floor—with a good strong poisonous sheep-dip, if anything even stronger that that used for dipping sheep. It is important that all crevices receive special attention. If the shed is off the ground and it is possible for you to do so, the ground underneath should receive a thorough coating of newly slacked lime. Any articles removed from the shed prior to treatment should not be returned unless they are also thoroughly disinfected. If this treatment is carried out properly you may succeed, but the weevil is an extremely difficult pest to deal with.

LIQUID-MANURE DISTRIBUTOR.

FORREST WALLS, Kennington :—

Can you inform me of any liquid-manure sprinkler or vehicle for the purpose of spreading liquid manure as a top-dressing—with the outlet controlled from the driving-seat?

The Fields Division :—

We do not know of any liquid-manure distributor of colonial make. Such distributors are, of course, obtainable from British firms of implement-makers, but could not be procured at present. A serviceable cart could be made by mounting a tank on an ordinary cart-frame. A perforated zinc trough of suitable width could be constructed and attached to the rear of the cart. A pipe with regulating-valve connecting the tank with the distributing-trough would complete the arrangement.

ACORNS FOR POULTRY.

"SUBSCRIBER," Timaru :—

Is it advisable to give poultry raw acorns after the latter have been put through a bone-mill, or should one boil them and put them in the mash ?

The Live-stock Division :—

Acorns may be ground and fed raw, but only in a very limited quantity, otherwise they have the effect of giving the eggs an objectionable green colour. Especially does this apply when the acorns are fed to ducks.

CONDITIONS FOR LUCERNE ESTABLISHMENT.

JAMES KELLY, Waitaki :—

Kindly let me know whether lea ground ploughed up in the winter and then worked up in the spring would be suitable for sowing lucerne, or would it be advisable to sow it in land that has been previously cropped ?

The Fields Division :—

Good results have been obtained from sowing lucerne immediately after a lea which contained no yarrow or couch. Dry conditions in early summer are, however, unfavourable to lucerne thus sown, and as a rule it is better to sow on previously cropped ground.

COW WITH MANGE.

"PUZZLED," Hastings :—

I have a cow that has a sort of mange, mainly behind the ears and around the eyes. The cow is always rubbing the spots on a post or along the wires of the fence, and the skin is broken. The cow is fat, and there is no sign of lice. It does not appear to be ringworm. Will you please tell me how to treat her.

The Live-stock Division :—

We would advise you to try the following : Lanolin, 80 parts ; olive-oil, 40 parts ; salicylic acid, 20 parts. Apply every third day ; before using wash the parts affected with soap and water, allow to dry, then apply the ointment.

DESTRUCTION OF CALIFORNIAN THISTLE.

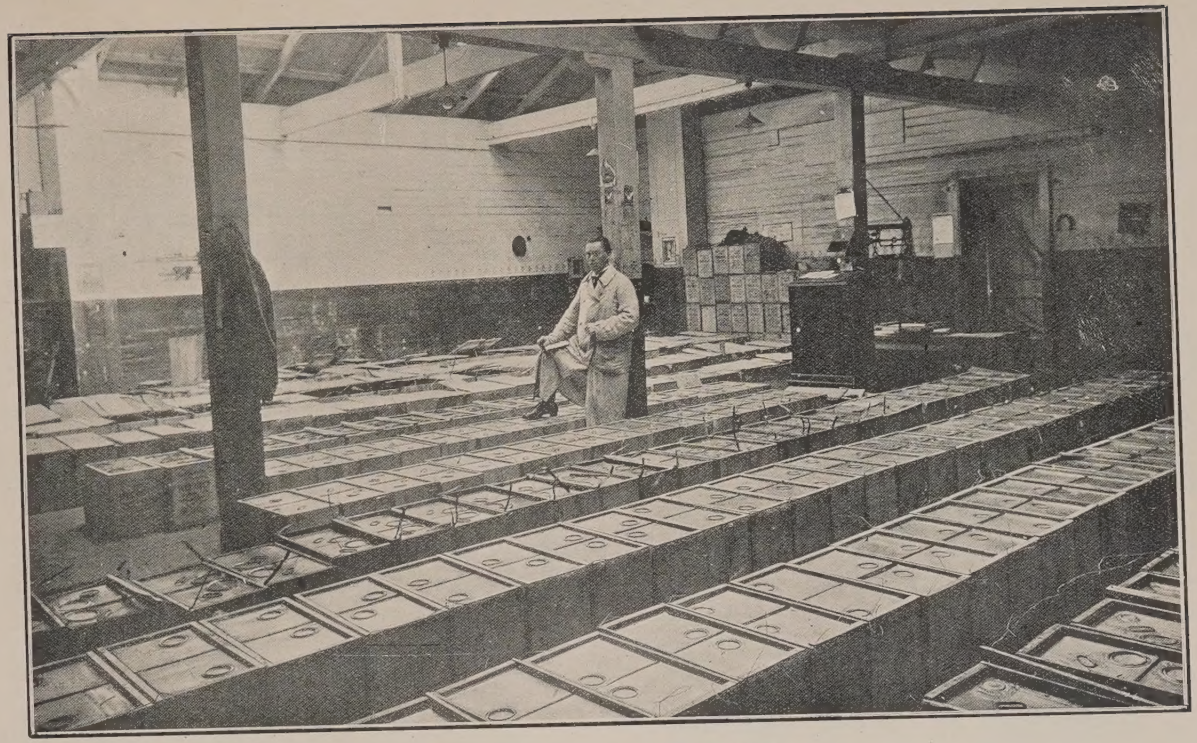
H. W. GIESEN, Dannevirke :—

I have a paddock which has been ploughed, and now contains about 10 acres of Californian thistle. I propose to allow this to lie fallow all the next summer, and to put a spring-tooth cultivator over it about every fortnight, or as often as the thistle shows through. Can you tell me if this will destroy the thistle, and, if not, what is the best method ?

The Fields Division :—

We do not think that the scheme outlined would suffice to kill the thistle. Sowing with lucerne, using at least 30 lb. of seed to the acre, should prove more effective.

NOTE.—A Warepa correspondent who inquires regarding Indian-runner ducks has not given his name.—ED.



HONEY IN GRADING-STORE, WELLINGTON.

The grading of export honey is carried out by officers of the Apiary Section of the Horticulture Division. Some seven thousand cases of honey, equal to about 350 tons weight, are at present awaiting shipment at various ports of the Dominion.

FARMS AND HOMES FOR DISCHARGED SOLDIERS.

FARMS are available for selection by discharged soldiers in various parts of the Dominion, on good tenures and easy terms. Over 650 discharged soldiers have already secured holdings, and have good prospects of becoming successful farmers.

Any discharged soldier, or party of discharged soldiers, may obtain an option over a block of private land, and if the proposition is a satisfactory one the land will be purchased by the Crown and allotted in suitable areas.

Advances up to £500 (£750 in special cases) are made on current account, at 5 per cent. per annum interest, to assist settlers in improving and stocking their sections, and erecting buildings and fences.

Advances are also made for—(*a*) Purchasing private or Native land with improvements thereon (including dwellings); (*b*) acquiring a Crown lease by transfer; (*c*) improving land owned in fee-simple by a discharged soldier; (*d*) discharging a mortgage on land owned by a discharged soldier, or held by him under lease from the Crown; (*e*) purchasing plant, implements, stock, &c., for land owned in fee-simple by a discharged soldier.

The Crown Lands Guide, obtainable at any Land Office, contains descriptions, values, rentals, &c., of sections now available for selection; and a poster containing particulars of lands to be opened each month is sent to every post-office in the Dominion.

Any discharged soldier desirous of going on the land, acquiring a home, or obtaining financial assistance to work land owned by him should write for advice and information to the Commissioner of Crown Lands for the district in which he desires to settle.

SHEEP IN NEW ZEALAND.

THE usual annual interim statement of the number of sheep in the Dominion as at 30th April has been issued by the Government Statistician, and shows for 1918 an increase of 1,084,208 head compared with the final figures for the previous year. It may be mentioned that the returns, which are collected by the Department of Agriculture, are this year considered to be close up to final. The following table gives particulars by sheep districts:—

Sheep District.	Number of Sheep.		Increase.	Decrease.
	1917.*	1918.		
Auckland	1,983,510	1,968,960	..	14,550
Napier-Gisborne	6,732,883	6,804,435	71,552	..
Wellington-West Coast ..	5,850,735	5,900,776	50,041	..
Marlborough-Nelson-Westland	1,364,469	1,402,000	37,531	..
Canterbury-Kaikoura ..	4,718,026	5,330,139	612,113	..
Otago	4,620,763	4,948,284	327,521	..
Totals	25,270,386	26,354,594	1,084,208	..
Net increase—				
North Island			107,043	..
South Island			977,165	..
Dominion			1,084,208	..

* Complete returns.